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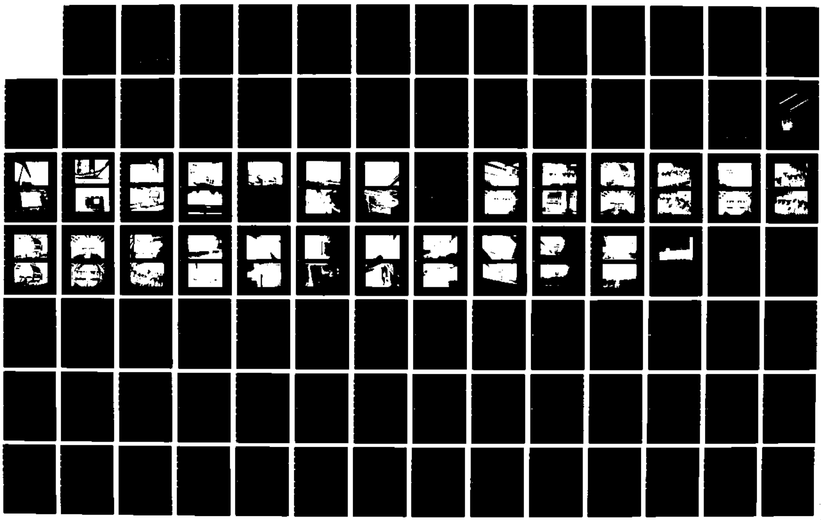

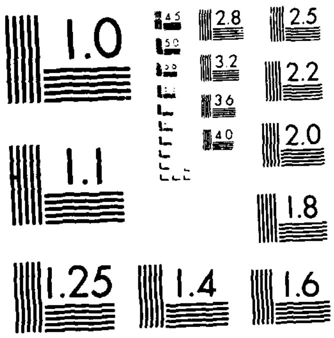

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Longitudinal Impact Test of a Transport Airframe Section

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July 1988

Final Report

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16. Abstract

This report presents the results of longitudinally impact testing a 10-foot section of a transport airplane at peak acceleration and corresponding velocity changes of 7.4g (22.4 ft/sec) and 14.2g (36 ft/sec), respectively. The purpose of the tests was to measure the responses of the fuselage and floor structure to simulated dynamic crash loads. The airframe test section included a full complement of seats and dummies. Acceleration and load/deflection response measurements were obtained from the instrumented fuselage, floor and seat/dummy installation.

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PREFACE

This report was jointly prepared by the Federal Aviation Administration (FAA) Technical Center and the Transportation Research Center of Ohio (TRC) under Contract DTFA03-87-00013. The report contains a description of the longitudinal impact tests which were performed using a FAA furnished airframe section and TRC's 24-inch diameter Hyge Shock Tester. The project was administered by Mr. Dick Johnson, FAA Transport Program Manager with contractor facility support provided by Mr. Jim Blaker, TRC Technical Program Manager. Technical assistance was provided by Mr. Stephen Soltis, FAA Crash Dynamics National Research Specialist.

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EXECUTIVE SUMMARY

A 10-foot section from a transport airframe was longitudinally impact tested at the Transportation Research Center of Ohio (TRC). The purpose of the test was to measure the structural responses and interaction between the fuselage/floor structure and the cabin/occupant restraint systems under simulated, potentially survivable, impact conditions. Utilizing TRC's 24-inch Hyge shock tester, two tests were conducted at peak acceleration and corresponding velocity changes of 7.4g (22.4 ft/sec) and 14.2g (36 ft/sec), respectively. The airframe test section was loaded to include a full complement of passenger seats and dummies.

Accelerations and load/deflection response measurements were obtained from the instrumented fuselage, floor, seats and anthropomorphic dummy test specimens. The input acceleration pulses were triangular in shape. Peak longitudinal floor acceleration levels ranged from 7.6g to 7.8g and 14.7g to 15.0g for the first and second tests, respectively. The six modified seats and dummy test specimens remained intact and totally restrained during both the 7.4g and 14.2g impact tests. Some structural deformation of the seat cross and spreader tubes was observed during post-test examinations. The fuselage and cabin floor structure exhibited neither visible damage nor deformation during the tests.

INTRODUCTION

The longitudinal impact test of a transport airframe section is one in a series of section and full-scale tests conducted in support of the Federal Aviation Administration's (FAA) current Crash Dynamics and Engineering Development Program (reference 1). Such tests included the Full-Scale Transport Controlled Impact Demonstration (reference 2) and subsequent Vertical Drop Test of a Transport Airframe Section (reference 3). The objective of the subject test was to determine the interaction between a transport airplane fuselage and floor structure and the cabin/occupant restraint systems under longitudinal impact conditions which are considered potentially survivable. Baseline response data obtained from these tests will be used to determine the dynamic response characteristics of the airplane and verifying analytical computer programs such as the lumped mass model "KRASH" (reference 4).

In tests conducted at the Transportation Research Center of Ohio's Impact Simulator Test Facility, a 10-foot long airframe section was longitudinally impact tested at peak acceleration and corresponding velocity changes of 7.4g (22.4 ft/sec) and 14.2g (36 ft/sec), respectively. These impact levels were selected from a structural analysis of the airframe section as verified by static testing of a similar section specimen (reference 5). The airframe section was fully loaded to include a maximum configuration of cabin seats and dummy occupants. Structural response data were obtained during impact from instrumentation installed in the fuselage structure, floor structure, seats, and dummy test specimens. The location of this instrumentation is included in appendix A. The traces of recorded acceleration and load/deflection responses are included in appendix B, with calibration data contained in appendix C. Also included in appendix C are data and photographs from static pull tests that were conducted on the seat tracks above the beam at BS1180 and subsequent to the subject longitudinal impact tests. The report also includes pre-test and post-test photographs of the airframe test section and cabin installations.

DESCRIPTION

TEST SPECIMEN

The airframe test specimen was a 10-foot section cut from the aft fuselage of a B707 transport airplane. As shown in figure 1, the section structure, characterized by a tapered lower fuselage shell area, was separated just forward of the rear galley between body stations (BS) 1120 and 1240. The section was configured with three rows of two triple passenger seats Each of the triple seats was strengthened to meet the higher load requirements. Also, these seats, Burns Aero Model 799, were positioned fore and aft to accommodate a representative floor test load condition (34-inch pitch) and to assure that the middle row of seats would maximize the dynamic loading of the floor beam at BS 1180. Each seat pan contained an anthropomorphic dummy weighing approximately 165 pounds. The dummies were restrained by standard American Safety model 500082 seatbelts.

To ensure structural integrity and the elimination of inherent open-end effect, the section floor structure was modified, as illustrated in figure 2A. This modification consisted of reinforcing the end floor beams by adding additional beams of BS 1120 and 1240. These beams and existing beams were tied together with (5) longitudinal hat section stringers. These stringers replaced the original under floor cargo liner attachment members which had been inadvertently removed. Such members also provided for stability of the floor beams. In addition, the shear strength provided by the outboard floor panel attachment fasteners was increased by doubling the number of fasteners around the periphery of each outboard panel.

Each of the six seats was structurally modified to absorb, without failure, the higher expected impact loads. Illustrated in figure 2B, these modifications involved the installation of reinforcement gussets at both fore and aft leg locations. In addition, the seat spreader tubes were filled with epoxy to prevent collapse resulting from the occupant seat belt loads. Verification of performance associated with these seat modifications was accomplished through separate dynamic impact sled tests conducted at the FAA Civil Aeromedical Institute (CAMI) (reference 6). These tests also provide for a basis to calibrate the output from strain gages installed on the six seat leg structures.

Table 1 provides a list of the airframe section and equipment installation weights. Excluding the onboard equipment, i.e., seats, dummies, etc., the bare airframe section weighed 1900 pounds. The total weight of the test section with seats and dummies was 5498 pounds.

FACILITY AND TEST METHOD

The test specimen was longitudinally impact tested at the Transportation Research Center of Ohio's Impact Simulator Facility. A description of the facility is contained in appendix D.

A test fixture was designed and fabricated to attach the fuselage section to the test sled. The critical design constraints were to keep the weight to a minimum and to minimize the effect of the fixture on the structural

TABLE 1 AIRFRAME TEST SECTION INSTALLATION WEIGHT

ITEM	DESCRIPTION	LOCATION*	TOTAL WEIGHT (lb.)
AIRFRAME SECTION		BS1120-1240	1900
SEAT A	BURNS-AERO	6.5 IN. AFT	100
	MOD. 799 S/N 80226	OF BS 1140	
SEAT B	BURNS-AERO	6.5 IN. AFT	102
	MOD. 799 S/N 84700	OF BS 1140	
SEAT C	BURNS-AERO	2.5 IN. AFT	102
	MOD. 799 S/N 102844	OF BS 1180	
SEAT D	BURNS-AERO	2.5 IN. AFT	96
	MOD. 799 S/N 85049	OF BS 1180	
SEAT E	BURNS-AERO	3.5 IN. FORWARD	101
	MOD. 799 S/N 84729	OF BS 1220	
SEAT F	BURNS-AERO	3.5 IN. FORWARD	101
	MOD. 799 S/N 89028	OF BS 1220	
DUMMIES			
SEAT A	DOT PART 572	WINDOW SEAT	167
	DOT PART 572	CENTER SEAT	167
	DOT PART 572	AISLE SEAT	167
SEAT B	DOT PART 572	WINDOW SEAT	167
	DOT PART 572	CENTER SEAT	167
	DOT PART 572	AISLE SEAT	167
SEAT C	DOT PART 572	WINDOW SEAT	167
	DOT PART 572	CENTER SEAT	167
	DOT PART 572	AISLE SEAT	167
SEAT D	DOT PART 572	WINDOW SEAT	167
	DOT PART 572	CENTER SEAT	167
	DOT PART 572	AISLE SEAT	167
SEAT E	DOT PART 572	WINDOW SEAT	167
	VIP 50	CENTER SEAT	165
	HYBIRD III	AISLE SEAT	164
SEAT F	VIP 50	WINDOW SEAT	165
	DOT PART 572	CENTER SEAT	167
	HYBRID III	AISLE SEAT	164

*MEASUREMENTS TO REAR LEG OF EACH SEAT

integrity of the airframe by not altering the floor-fuselage shell interface load path. Figures 3 through 7 illustrate the method of attaching the test specimen to the test fixture and the test fixture to the test sled.

The fuselage attachment design was based on separating the reacting loads into horizontal and vertical components; the horizontal loads resulting from the longitudinal acceleration and vertical loads resulting from the test specimen weight and the over-turning moment from the longitudinal acceleration.

The horizontal loads were transferred to the test fixture by two horizontal attachments on each side of the fuselage. These attachments were located at waterlines 196 and 238 and consisted of 1/8" thick X 6" wide steel plates bolted to the fuselage skin. Epoxy adhesive K-200 was also used to bond the steel plates to the fuselage. These attachments are illustrated from the outside by figure 3 and from the inside by figure 4.

The vertical loads were transferred to the test fixture by two vertical attachments on each side of the fuselage. These attachments were located at body stations 1120 and 1240 and consisted of 1/8" thick X 4" wide steel plates bolted to the fuselage skin. Epoxy adhesive was also used to bond these plates. These attachments are illustrated from the outside by figure 5 and from the inside by figures 6 and 7.

These attachments were then bolted to the test fixture along these same horizontal and vertical locations.

To help react the over-turning moment, an extension to the sled was designed and fabricated. The fixture with the sled extension is shown in figures 8 and 9.

Trial tests were conducted to verify the input pulse parameters and the structural integrity of the test fixture. To simulate the weight and moment of the test specimen, I-beams weighing 6,000 pounds were attached to the top of the fixture. Trial tests were conducted at peak acceleration and corresponding velocity changes of 7.1g's (23.6 ft/sec) and 13.2g's (39.2 ft/sec), repectively. The input pulse was triangular shaped with durations of 183 and 174 milliseconds, respectively. Inspection of the test fixture and a review of the trial test film did not reveal any evidence of damage.

After successful completion of the trial tests, the fuselage section and its contents were installed. Two tests were conducted. The first test was conducted with a peak acceleration level of 7.4g and the second with a peak acceleration level of 14.2g. Eight high-speed cameras (500 frames per second), one real-time and one video camera were used to photograph each longitudinal impact. Three of the high-speed cameras were onboard. The other five high-speed cameras, the real-time and the video camera viewed the test from offboard. The onboard camera locations are shown in figures 10 and 11.

INSTRUMENTATION

The airframe section and seat installations were instrumented with accelerometers, strain gages, and load cells as identified in table 2. Figures 12 through 17 show the general placement of each sensor installation and appendix A provides a further description of these sensors with exact X, Y, and Z position coordinates. As shown in figure 12, the majority of instrumentaton was installed at BS 1180 which involved the floor beam, track and fuselage frame. Accelerometers were mounted on the two inboard tracks forward of BS 1180, and on one inboard track at BS 1120 and 1240. A typical installation is identified in figure 13. In addition, accelerometers were also installed at three above-floor-frame locations at BS 1180 as shown in figure 14. Also, the floor beam at BS 1180 included four web mounted strain gage bridges and four string potentiometers at each track intersection location as shown in figures 15, 16, and 17. Instrumentation of the modified seat specimens involved triaxial accelerometers placed at the aft cross tube of both center row seats (#C and #D). Accelerometers and seat belt load cells were also installed on the anthropomorphic dummy at each of these center seat positions. In addition, each of the six seats contained axial strain gage bridges installed at their forward leg(s) and diagonal structure(s) as illustrated in figure 15a. These gages were calibrated from sled tests performed previously at CAMI (reference 6). The calibrated sled tests involved subjecting each seat with anthopomorphic dummies to low energy triangular impact pulses of 9g's (26 ft/sec, 180 msec). Resulting seat strain gage data were recorded along with measured loads obtained from load cells located at each leg-track attachment point. From the seat strain gage responses measured during the subject longitudinal tests, floor reaction forces can be determined from the CAMI calibration data. Calibration of the floor beam at BS 1180 was accomplished in a similar manner but subsequent to the completion of the two longitudinal impact tests. A static floor calibration method and results are described in appendix C. Such tests involved statically loading the floor beam at each track intersection and measuring the load, deflection and corresponding strain gage reading at each gage location.

TABLE 2 INSTRUMENTATION

	Accelerometer Long	Lat	Vert	Strain Gage	Load Cell	String Pot.	Crack Detect	Vel.	Channel
Fuselage	3	-	-	-	-	-	-	-	3
Floor	4	3	3	4	-	4	5	-	23
Seats	2	2	2	14	-	-	-	-	20
Seat Belts	-	-	-	-	4	-	-	-	4
*Dummies (Pelvis)	2	-	2	-	-	-	-	-	4
Drive Fixture/Sled	2	-	-	-	-	-	-	-	2
TOTAL									56

*Seats C and D center positioned dummy only

DISCUSSION

TEST DATA

The airframe test section was longitudinally impact tested at both low and high energy impact conditions. The first test (test 01) involved subjecting the airframe and contents to a 7.4g peak acceleration. This test was conducted primarily to check test setup and verify that the seat strain gage readings were within the data range of data obtained from the previous CAMI tests (which involved a comparable test procedure). Figures 18 through 22 illustrate the test setup. Figures 23 and 24 illustrate the post-test positions of the dummies. No visual evidence of any deformation of the floor or seats was observed following this test. No failure at the crack detection wires was observed. However, one seatbelt did come loose from its anchor point. This occurred on the middle row, left-hand window seat. Figure 25 shows the released belt (later considered to have released as the result of being incorrectly installed.)

For the high energy condition, the airframe and its contents were then subjected to a 14.2g peak acceleration (test 02). Figures 26 through 31 illustrate the test setup and figures 32 through 35 provide post-test documentation of the dummies and seats. Again no visible evidence of deformation or damage to the fuselage or test fixture was observed. None of the installed crack detection wires failed. Some structural deformation occurred to the seats which was comparable to deformation observed under similar test conditions at CAMI. This deformation is documented in the post-test observations section.

Table 3 summarizes the peak longitudinal accelerations, peak seatbelt loads and maximum deflection of the floor. Table 3 also provides strain data (in millivolt units) as obtained from the floor beam and seat and diagonal brace strain gage installations. A complete set of data plots is included in appendix B. A conversion to floor reaction loads from the aforementioned strain gage readings is contained in appendix C.

DATA EXPLANATIONS

TEST 01

The Port Inboard Beam Strain (PIBS) and the Starboard Inboard Beam Strain (SIBS) data are suspect due to the great difference in magnitude.

TEST 02

The Seat C Longitudinal acceleration (SECXG) did not return to zero after the test. An accurate velocity integration could not be computed.

The Seat D Longitudinal acceleration (SEDXG) did not return to zero after the test. An accurate velocity integration could not be computed.

The Port Inboard Beam Strain (PIBS) and the Starboard Inboard Beam Strain (SIBS) data exceeded the requested full scale value.

TABLE 3. DATA SUMMARY

CHANNEL PEAK DECELERATION (g) & DELTA VELOCITY (ft/sec)	TEST 01 MAXIMUM	TEST 01 TIME (msec)	TEST 02 MAXIMUM	TEST 02 TIME (msec)
SLED LONGITUDINAL	7.4	102.4	14.2	81.8
VELOCITY	22.4	176.6	36.2	159.8
PORT INBOARD SEAT TRACK LONGITUDINAL - MID	7.6	99.9	14.7	79.6
VELOCITY	22.1	175.8	35.5	171.0
STARBOARD INBOARD SEAT TRACK LONGITUDINAL - AFT	7.7	95.8	14.7	79.1
VELOCITY	22.3	171.0	35.7	162.1
STARBOARD INBOARD SEAT TRACK LONGITUDINAL - MID	7.8	94.9	14.7	80.3
VELOCITY	22.2	170.9	35.8	158.1
STARBOARD INBOARD SEAT TRACK LONGITUDINAL - FORWARD	7.7	94.5	15.0	79.5
VELOCITY	22.4	173.9	36.0	162.5
PORT FUSELAGE LONGITUDINAL	7.9	96.0	15.2	79.6
VELOCITY	22.4	180.1	35.9	169.1
TOP FUSELAGE LONGITUDINAL	8.3	98.6	15.4	90.5
VELOCITY	22.7	172.3	37.1	168.6
STARBOARD FUSELAGE LONGITUDINAL	7.9	101.4	15.0	78.1
VELOCITY	22.4	174.1	35.2	148.5
SEAT C LONGITUDINAL	8.2	123.0	13.8	80.0*
VELOCITY	21.8	167.8	35.1	199.9*
SEAT D LONGITUDINAL	7.5	91.5	14.0	76.6*
VELOCITY	23.5	164.0	37.7	340.0*
SEAT C CENTER DUMMY PELVIS LONGITUDINAL	7.9	136.5	10.6	106.3
VELOCITY	10.7	174.5	8.1	124.4
SEAT D CENTER DUMMY PELVIS LONGITUDINAL	9.1	146.6	21.5	107.6
VELOCITY	9.5	160.5	16.8	141.4

TABLE 3. DATA SUMMARY CONTINUED

CHANNEL LAP BELT LOADS (lb)	TEST 01 MAXIMUM	TIME (msec)	TEST 02 MAXIMUM	TIME (msec)
SEAT C CENTER DUMMY OUTBOARD LAP BELT	335.0	135.8	799.0	156.5
SEAT C CENTER DUMMY INBOARD LAP BELT	587.6	132.9	1130.3	156.5
SEAT D CENTER DUMMY OUTOBARD LAP BELT	569.5	136.3	1011.6	102.6
SEAT D CENTER DUMMY INBOARD LAP BELT	813.3	136.6	1116.2	168.5
SEAT TRACK DEFLECTION (in)				
PORT OUTBOARD SEAT TRACK	0.13	139.6	0.35	152.9
PORT INBOARD SEAT TRACK	0.29	142.1	0.66	152.1
STARBOARD INBOARD SEAT TRACK	0.34	140.6	0.60	160.5
STARBOARD OUTBOARD SEAT TRACK	0.25	135.5	0.44	156.8
1180 BEAM STRAIN (mv)				
PORT OUTBOARD	3.0	120.6	9.3	106.0
PORT INBOARD	6.3	143.8*	15.4	139.9*
STARBOARD INBOARD	12.6	135.0*	15.0	102.9*
STARBOARD OUTBOARD	4.7	132.8	7.4	155.8
SEAT A STRAIN (mv)				
OUTBOARD FORWARD LEG	6.4	151.5	12.0	202.8
OUTBOARD DIAGONAL STRUT	10.4	149.4	24.5	115.9
SEAT B STRAIN (mv)				
INBOARD FORWARD LEG	5.3	139.4	14.9	137.8

TABLE 3. DATA SUMMARY CONTINUED

SEAT C STRAIN (mv)	TEST 01 MAXIMUM	TEST 01 TIME (msec)	TEST 02 MAXIMUM	TEST 02 TIME (msec)
OUTBOARD FORWARD LEG	13.5	144.3	18.3	237.5
OUTBOARD DIAGONAL STRUT	8.3	124.8	20.8	115.8
INBOARD FORWARD LEG	3.8	258.3	18.6	219.3
INBOARD DIAGONAL STRUT	7.1	143.5	12.9	118.4
SEAT D STRAIN (mv)				
OUTBOARD FORWARD LEG	7.1	147.0	11.4	114.3
OUTBOARD DIAGONAL STRUT	10.7	145.8	21.0	115.4
INBOARD FORWARD LEG	5.0	136.1	9.7	115.1
INBOARD DIAGONAL STRUT	7.1	135.4	15.8	115.6
SEAT E STRAIN (mv)				
OUTBOARD FORWARD LEG	2.8	151.4	12.7	164.0
OUTBOARD DIAGONAL STRUT	10.1	146.5	19.6	118.1
SEAT F STRAIN (mv)				
OUTBOARD FORWARD LEG	2.5	148.1	9.7	242.6

*See DATA EXPLANATIONS

POST-TEST OBSERVATIONS

Seats (General) - The six modified seat and dummy test specimens remained intact and totally restrained during the 14.2g impact test (test 02). Post-test observation of each triple seat revealed no visible deformation of the basic leg and diagonal support structures while some structural deformation was noticed at each fore and aft cross tubes, primarily at the window side locations. Minor buckling was also observed at each of the seat frame spreader tubes and forward of the respective seatbelt retention ring attachment area. Both the first and second row seats experienced variable damage at the rear side of each seat back. This damage was caused by the head and/or knee strike from each of the aft positioned dummies.

Seat A (Row #1 LH) - As shown in figure 36, seat A experienced typical down bending of the left and forward window side cross tube. Compression buckling was also noticed at each of the three epoxy filled spreader tubes. Figure 37 depicts such tube buckling or wrinkling which is shown initiating at the seat belt ring attachment area. The three dummies in seat A were effectively restrained by each seatbelt system. Not withstanding this restraint, a deformed seatbelt retaining clip shown in figure 38 was observed at the aisle seat position. The crush and separation of the aft lower structure of the window and middle seat back was also observed in figure 39. This damage was caused by head and/or knee strikes stemming from dummies placed in the aft-position of seat C.

Seat B (Row #1 RH) - Front row seat B was observed to be in a similar post-test condition as seat A. The front and rear legs and diagonal support structure of seat B remained unaffected while deformation of cross tubes and spreader tube buckling (similarly observed from seat A) was evident. In addition, the rear aisle side spreader tube was found fractured at a doubler attachment point. Figure 40 shows typical head strike marks on the rear of each seat back and tray location.

Seat C (Row #2 LH) - The structure of seat C was found to have incurred the same type of impact deformation and buckling as subject to the forward row seats A and B. However, the bending of cross tubes was significantly less. Also, the crushing of each lower rear seat back (from aft located dummies) was not noticed in any of the seat positions. In view of this condition, figure 40 does show the separation of a tray section of the aisle position seat.

Seat D (Row #2 RH) - Like adjacent seat C in the second row, seat D experienced no leg damage with only minor deformation and buckling of the cross and spreader tubes. Similar seat back strike marks were identified from the rear positioned dummies.

Seat E (Row #3 LH) - Seat E also was observed to have experienced deformation and buckling of the cross tubes and spreader tubes. The aft cross tube at the aisle location was typically bent up with the forward tube bent down. Figure 41 shows the aft cross tube in a cracked condition.

Seat F (Row #3 RH) - As other seats, seat F was found with deformed and buckled cross tube and spreader tubes.

Seat Position Lock

Figures 42 through 47 show overviews and closeups of the locks which hold the seats in the seat tracks. Figure 42 shows both second row left side seat locks. Figure 43 shows the second row left side inboard seat lock and figure 44 shows the second row left side outboard seat lock. Figures 45, 46 and 47 show both second row right side seat tracks. Figure 46 shows the second row right side inboard seat lock and figure 47 shows the outboard seat lock. Some of the locks showed some tendency to raise up some during the 14.2g test but none released.

Seat Tracks

Figures 48 through 51 illustrate the seat tracks following the test. The seat tracks were measured for vertical deformation after the removal of all test articles. Only minor deformation was noted which may or may not be attributed to the test. The data are contained in table 4. Body stations 1120 and 1240 were used as reference points for each track.

TABLE 4

POST-TEST SEAT TRACK VERTICAL MEASUREMENTS

BODY STATION	LH OUTBOARD	LH INBOARD	RH INBOARD	RH OUTBOARD
1120	0.00	0.0	0.0	0.0
1140	0.00	-0.05	-0.04	-0.01
1160	+0.01	-0.03	-0.02	+0.02
1180	+0.03	+0.02	+0.03	+0.03
1200	+0.01	0.00	0.00	-0.03
1220	+0.07	+0.07	+0.06	+0.05
1240	0.00	0.00	0.00	0.00

MEASUREMENTS IN INCHES.

POSITIVE = ABOVE REFERENCE POINT   NEGATIVE = BELOW REFERENCE POINT

SUMMARY OF RESULTS

A Boeing [illegible] airframe section was instrumented and longitudinally impact tested at input energy levels of [illegible]4g ([illegible]2 ft/sec) and 14.2g (36 ft/sec), respectively. The test objective, which involved the measurement of fuselage, floor and seat structure responses to these simulated dynamic crash loads, were [illegible]. Response data pertinent to the occupant/seat restraint system performance were also recorded. From a post-test examination of the fuselage, floor and seat/occupant restraint system and related response traces, a summary of results are as follows:

1. The cabin fuselage shell and floor structure were observed to have no visible separation or structural damage.

2. The passenger seats were found to have experienced some buckling of their legs and structural cross tube members while remaining attached to the cabin floor-track structure.

3. The seatbelted dummies remained restrained within each seat location while head and leg contact was noted to have occurred between the second and third row dummies and forward seat back positions.

4. At the maximum impact conditions, peak longitudinal accelerations measured at the fuselage floor and seat structure locations were in the 14-15g range.

5. Individual lap belt loads measured at the two center positioned dummies varied between 335 and 813 pounds.

6. From string potentiometer data, the maximum floor-track deflections at impact were recorded at values between 0.35 and 0.66 inches.

CONCLUSIONS

1. The 24-inch Hyge Shock Tester provides an effective system for dynamically impact testing large full-scale aircraft fuselage sections.

2. The fuselage, floor and seat restraint system structures of large transport airplanes are capable of absorbing high dynamic impact loads in excess of current static load criteria.

3. Baseline response data have been obtained for use in the assessment of transport aircraft dynamic impact environments and occupant survivability characteristics.

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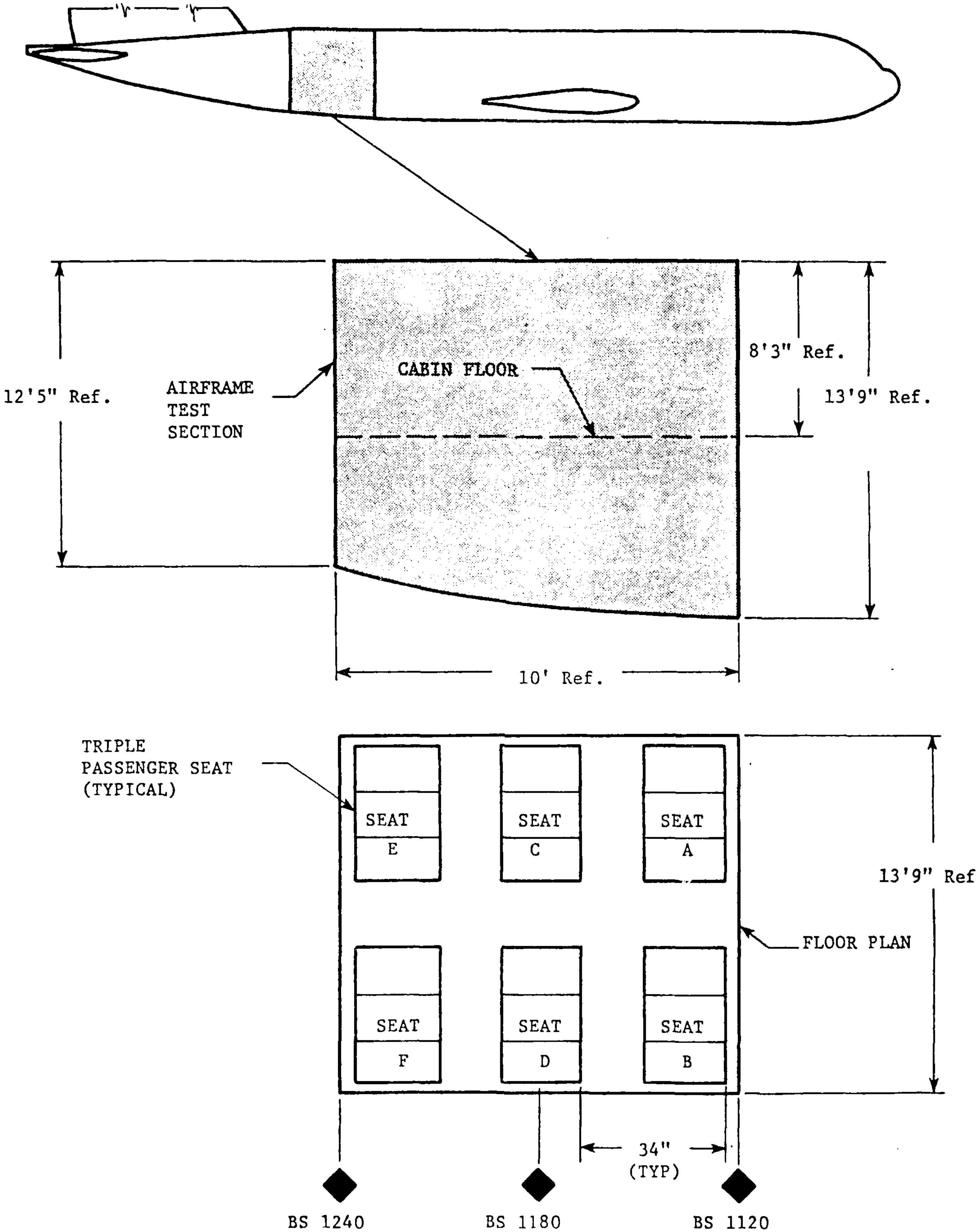
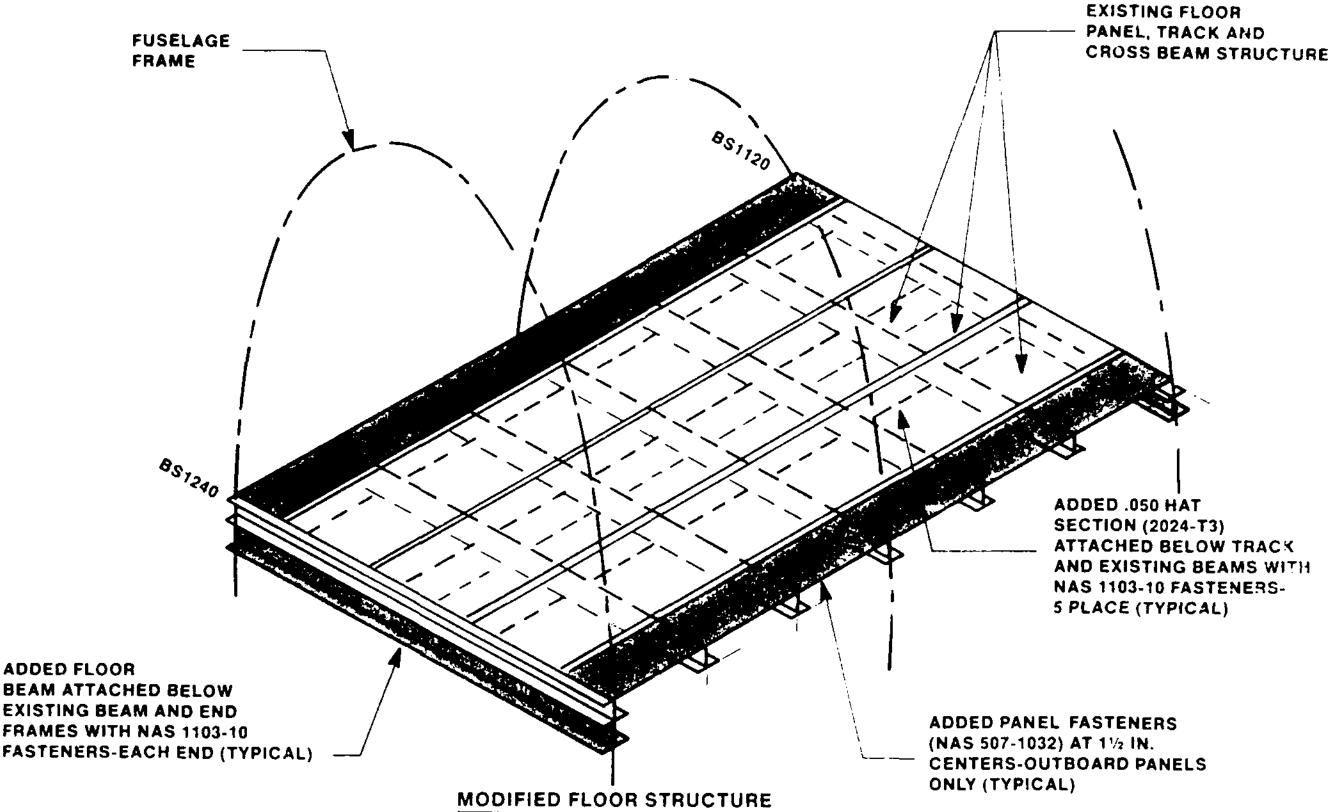
6. Gowdy, V., Burns Aero Calibration Seat Test, AAM-119-87-7, October 1987.



AIRFRAME TEST SECTION/FLOOR PLAN

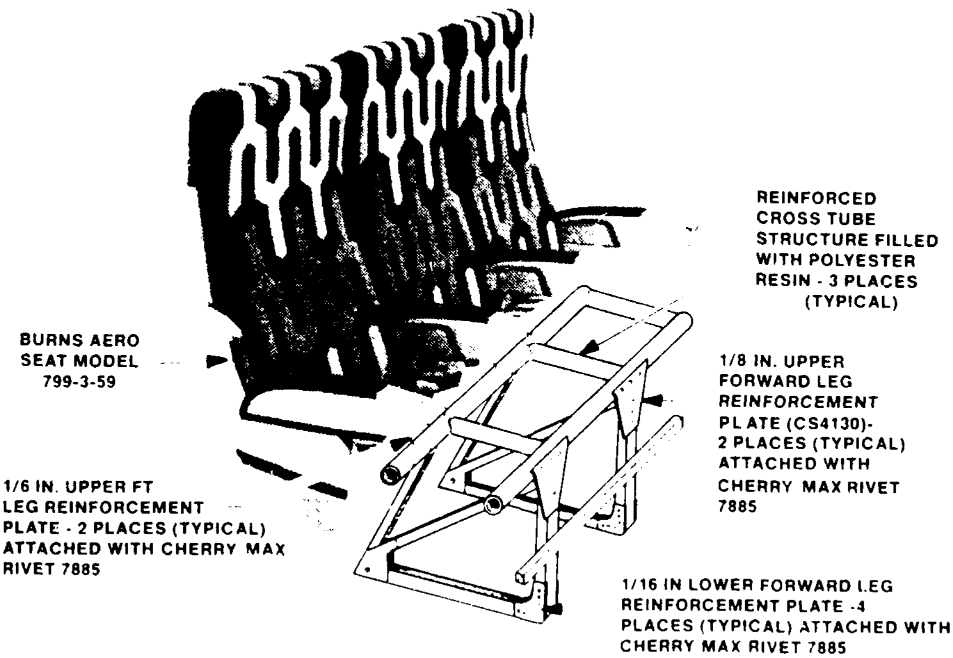
Figure 1

A



MODIFIED FLOOR STRUCTURE

B



MODIFIED SEAT STRUCTURE

FIGURE 2 - MODIFICATIONS

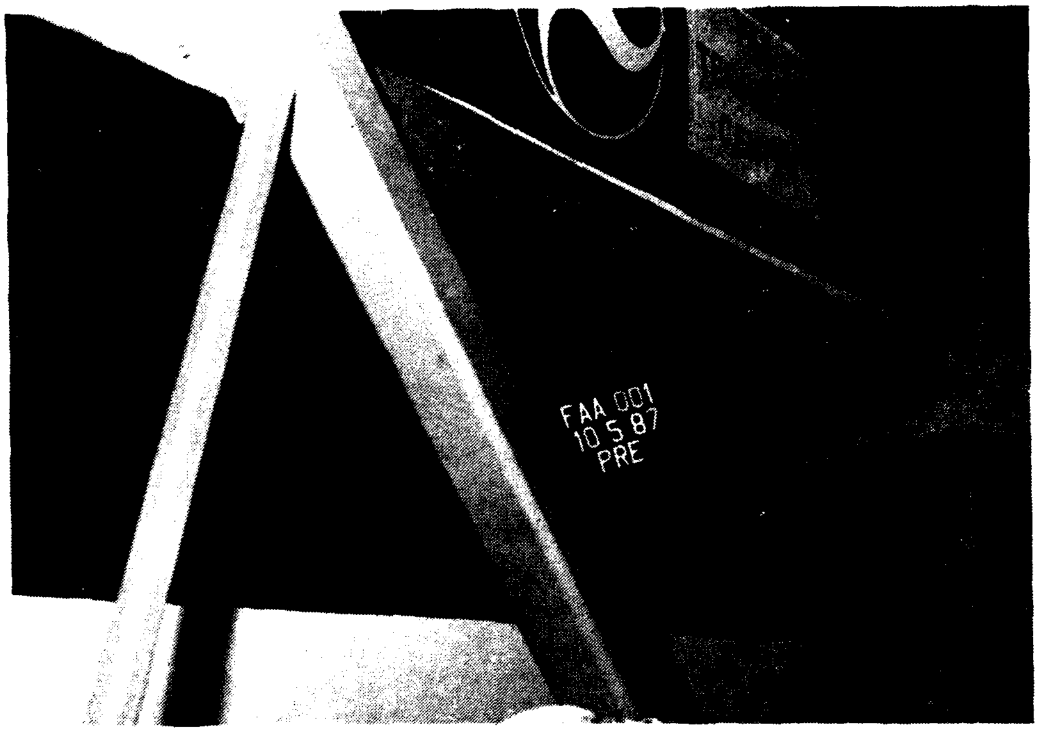


Figure FUSELAGE ATTACHMENT VIEW 1

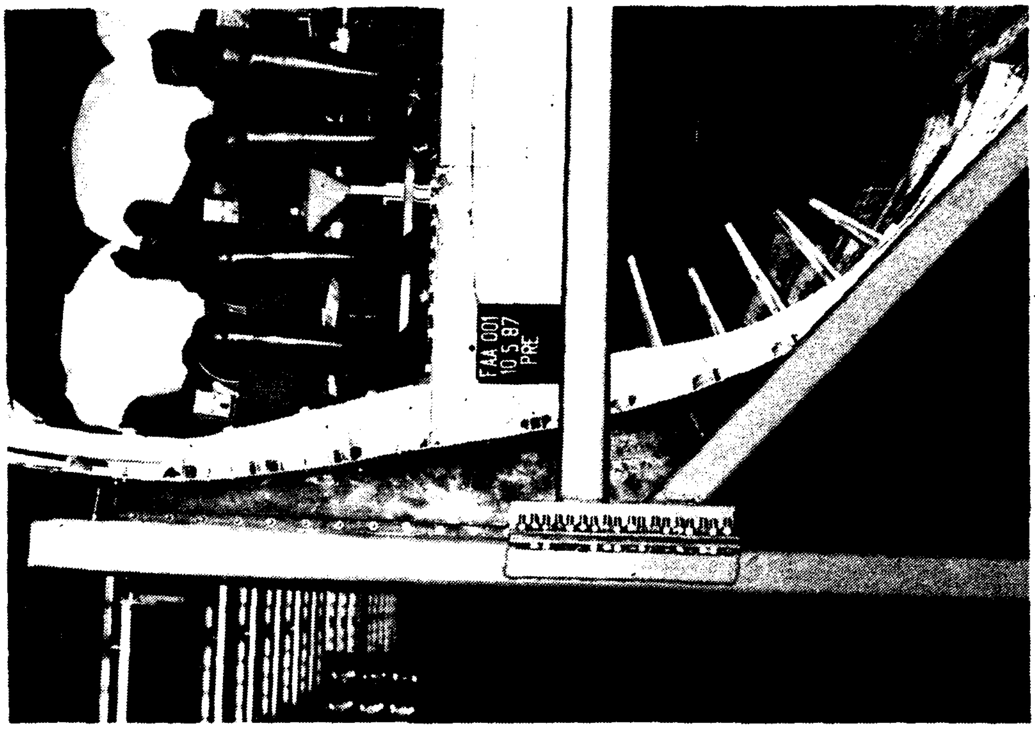


Figure 5. FUSELAGE ATTACHMENT - VIEW 3

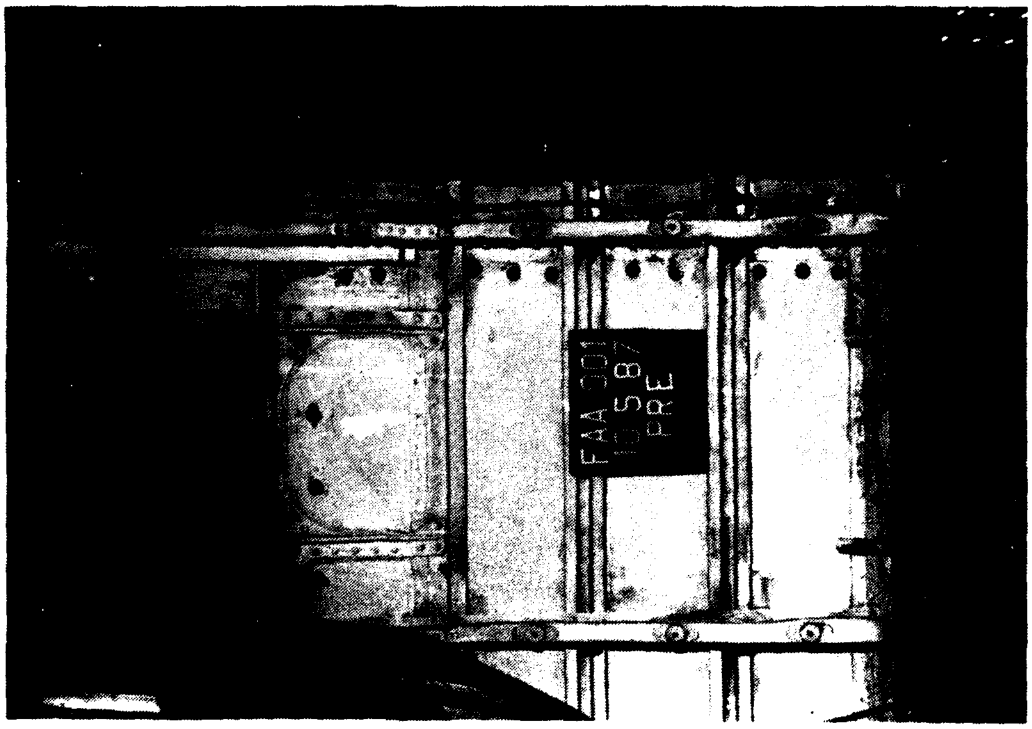
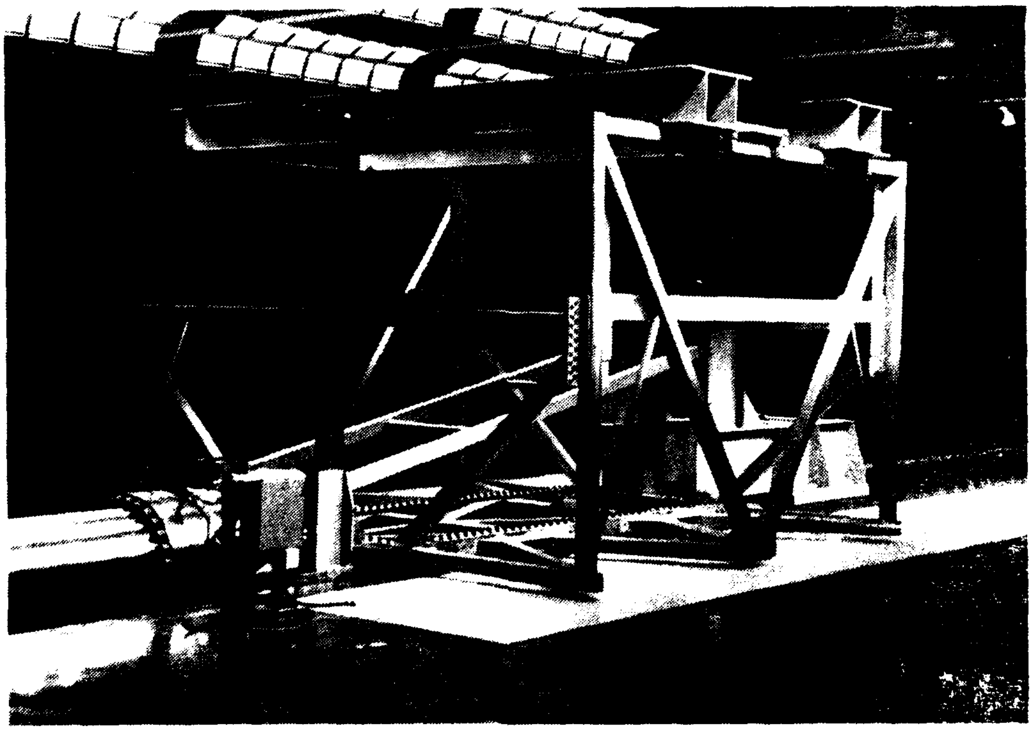


Figure 6. FUSELAGE ATTACHMENT - VIEW 4

Figure [illegible]. FUSELAGE ATTACHMENT CLOSE UP



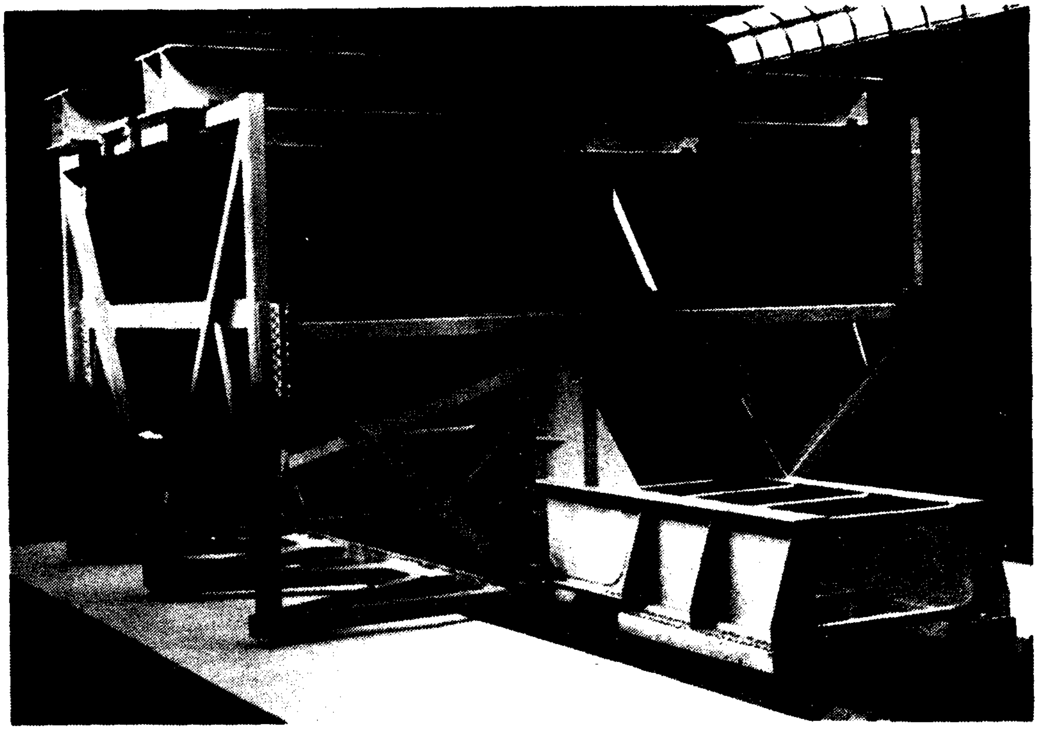
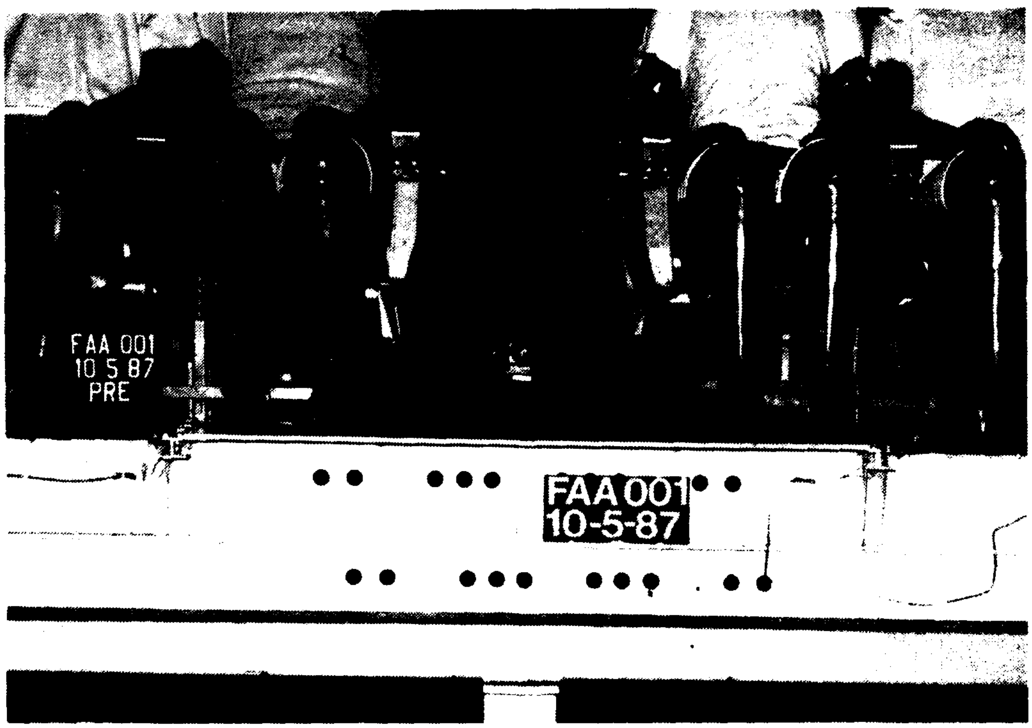


Figure 9 SLED EXTENSION



[illegible]

Figure 11. ONBOARD CAMERA LOCATION - VIEW 2

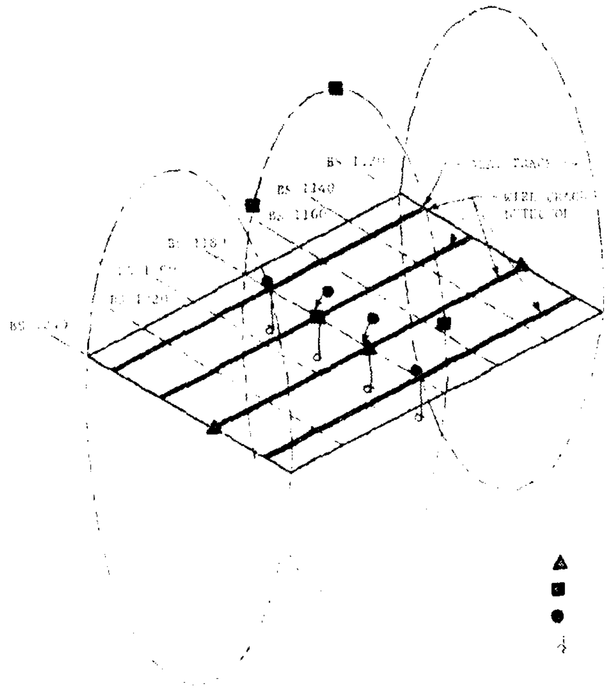


Figure 12. INSTRUMENTATION

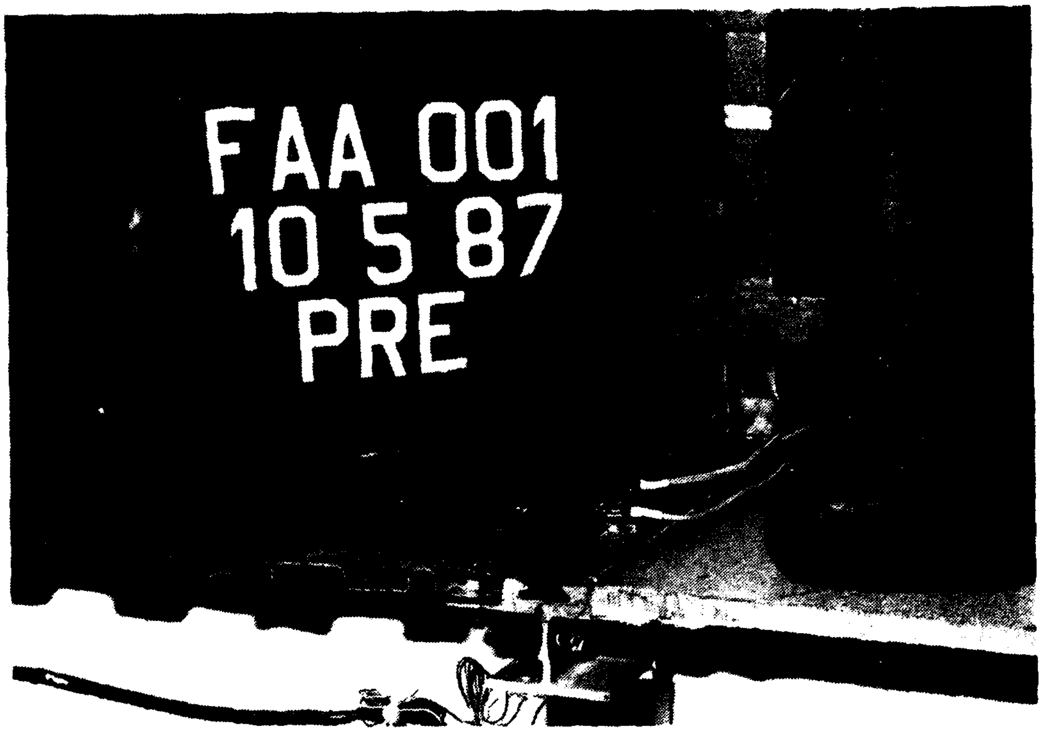
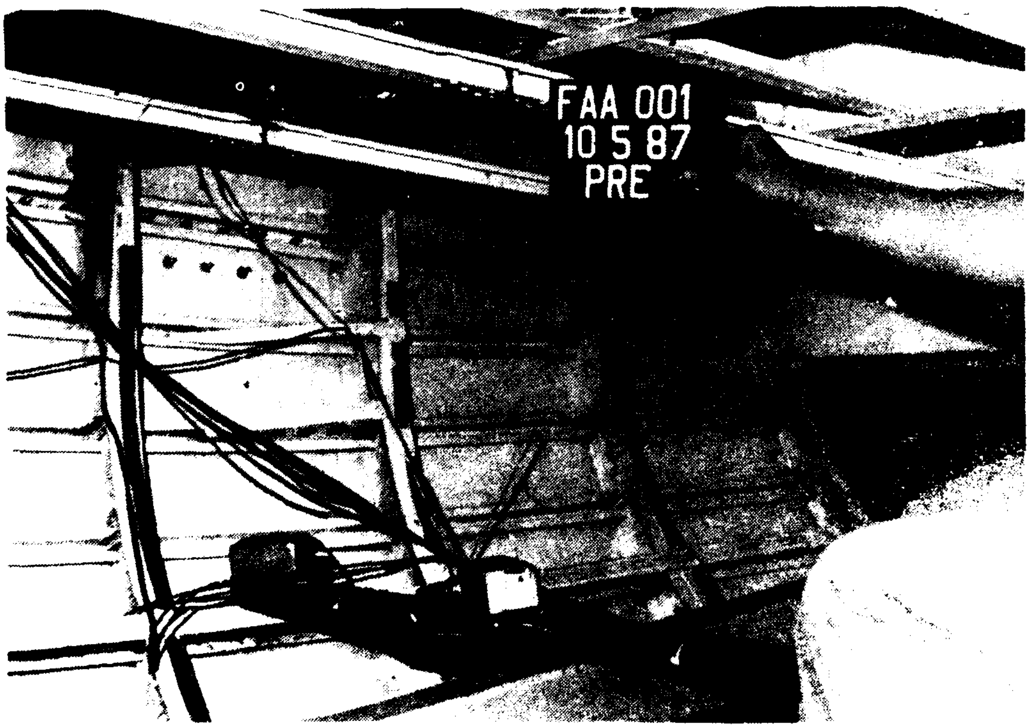


Figure [illegible] TYPICAL SEAT TRACK ACCELEROMETER [illegible]

Figure 4 [illegible]

Figure 15. TYPICAL STRAIN GAGE PLACEMENT



GAGE	LOCATION
1	LEFT FRONT
2	LEFT DIAGONAL
3	LEFT REAR
4	RIGHT FRONT
5	RIGHT DIAGONAL
6	RIGHT REAR

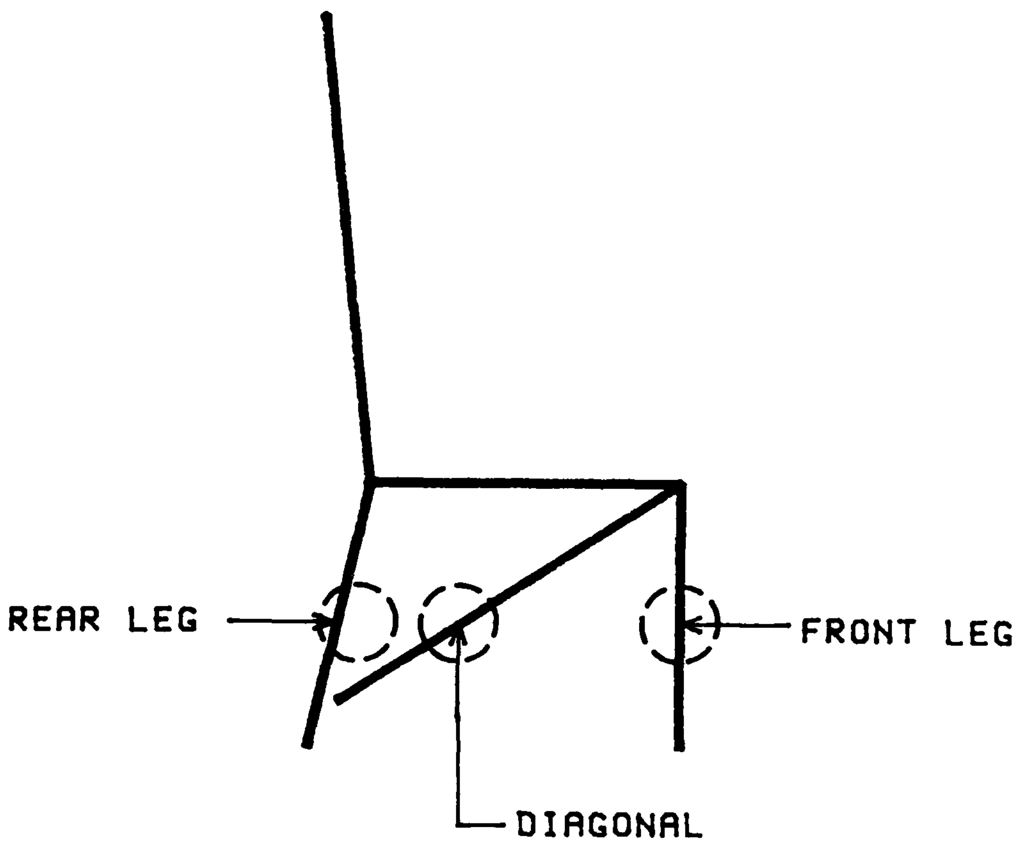


Figure 15a - Gage Locations

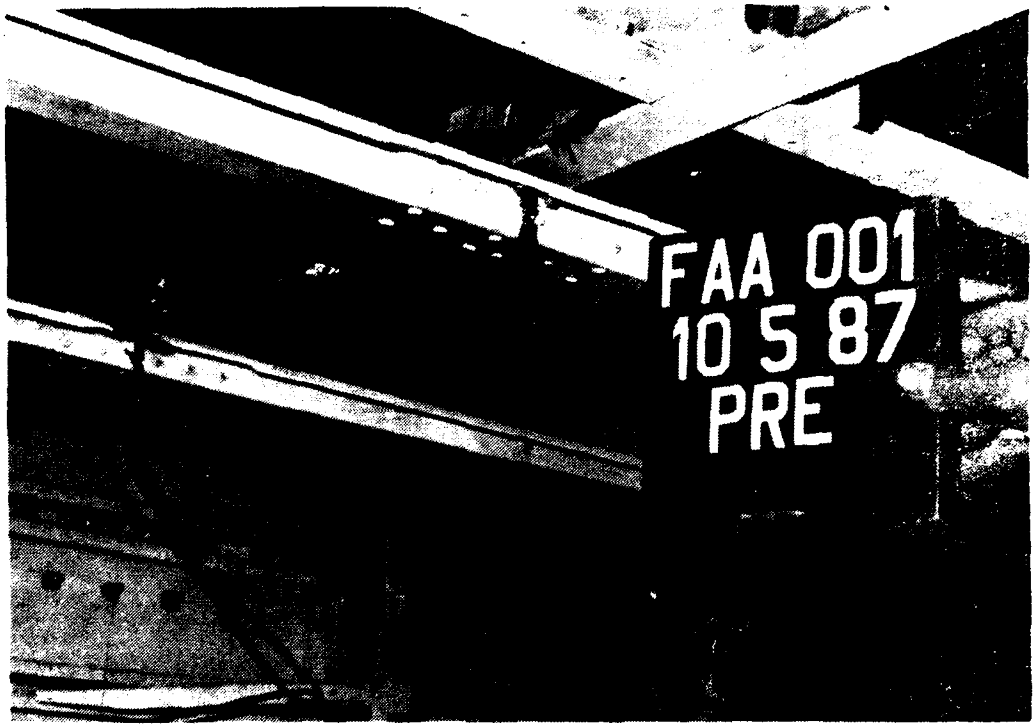
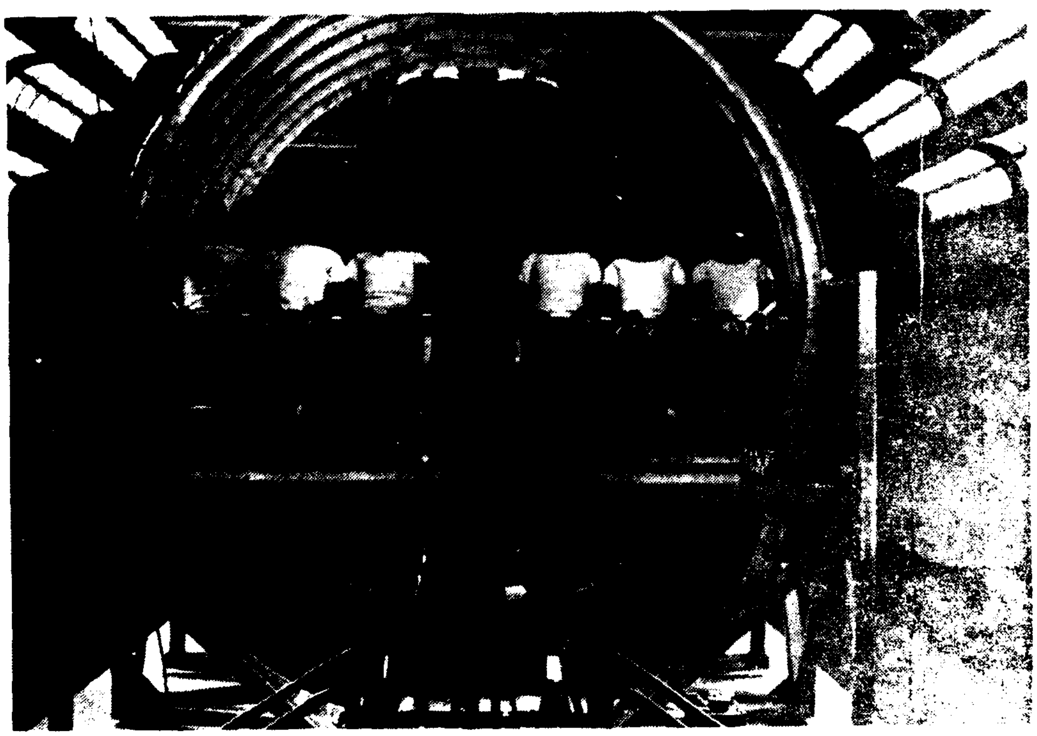
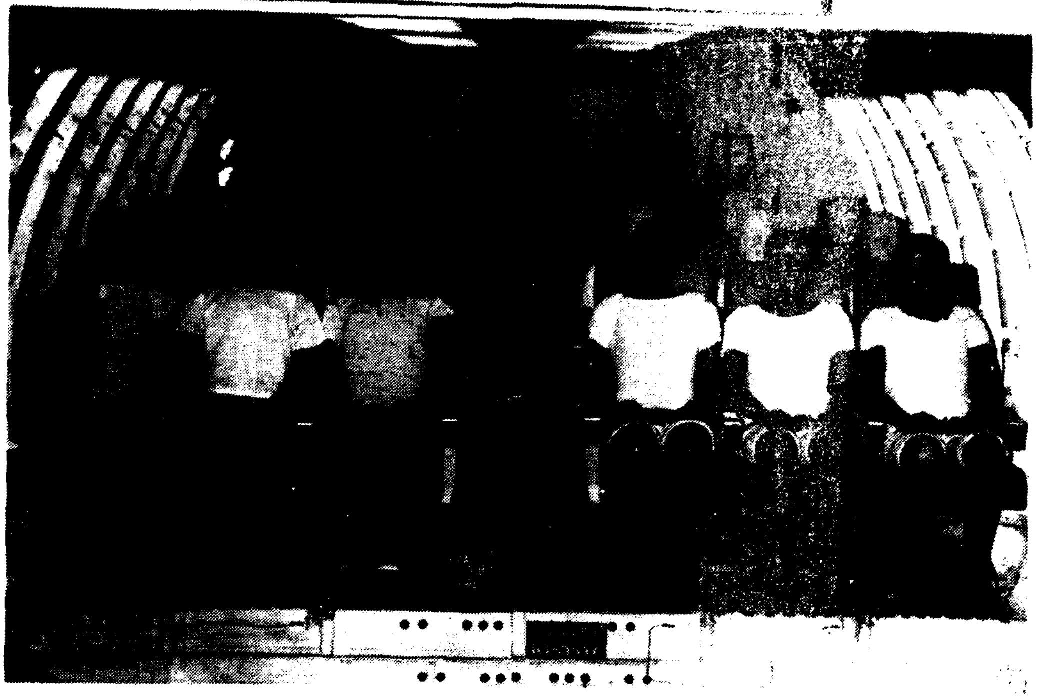
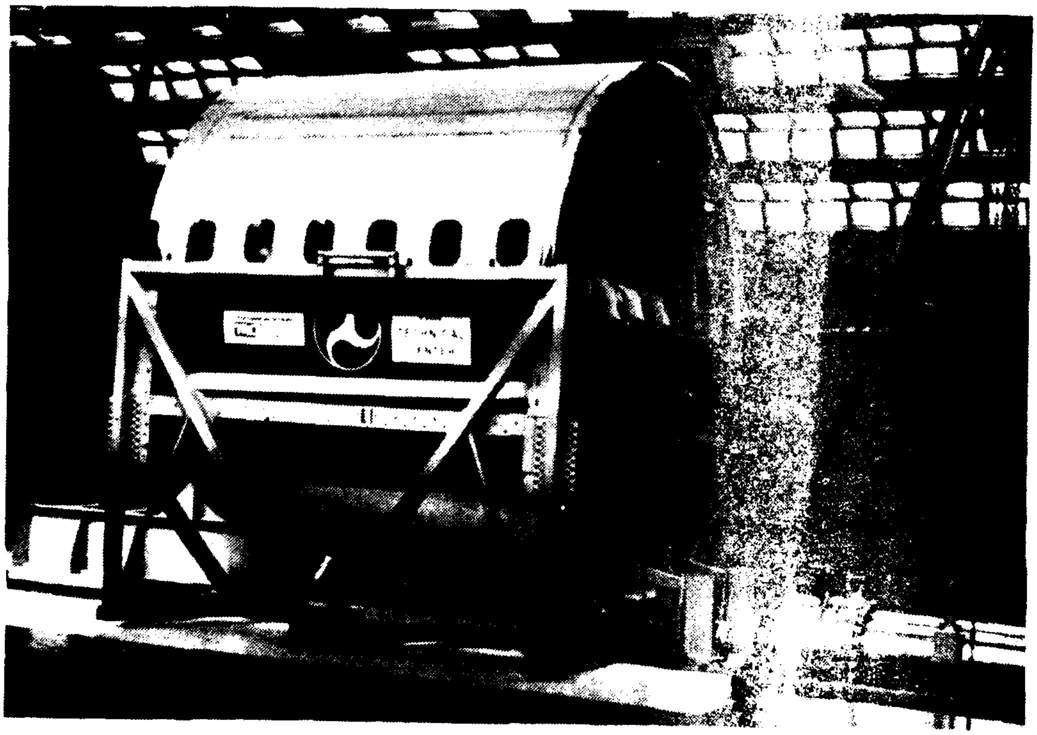


FIGURE [illegible] TYPICAL STRING POTENTIOMETER PLACEMENT





[illegible] 19. PRE TEST 01 FRONT V[illegible]



[illegible]

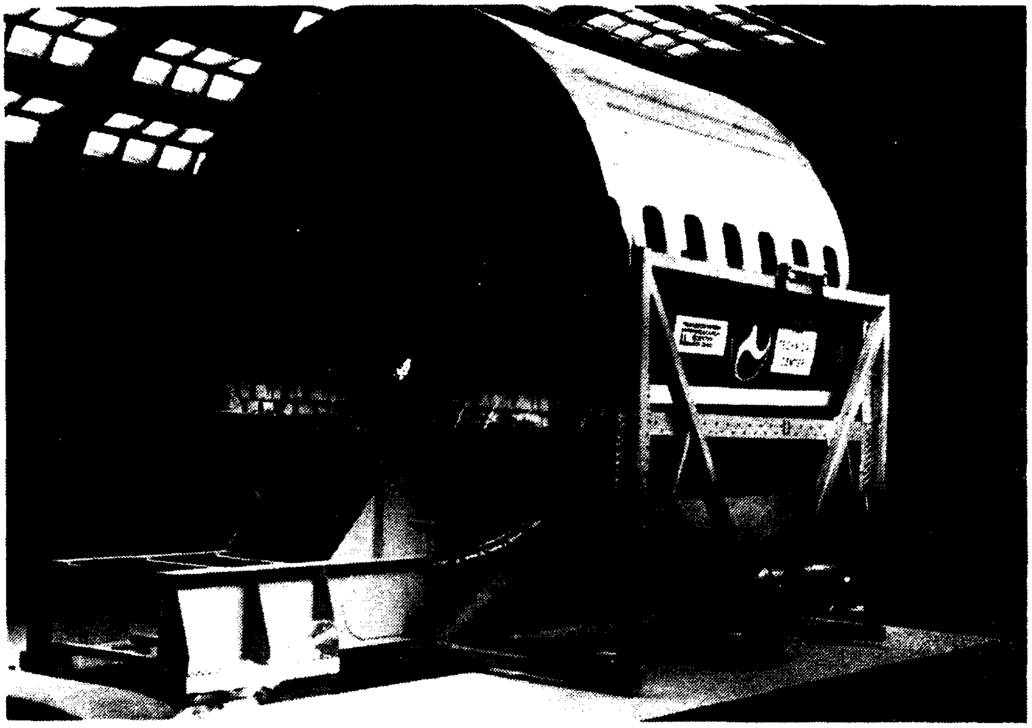
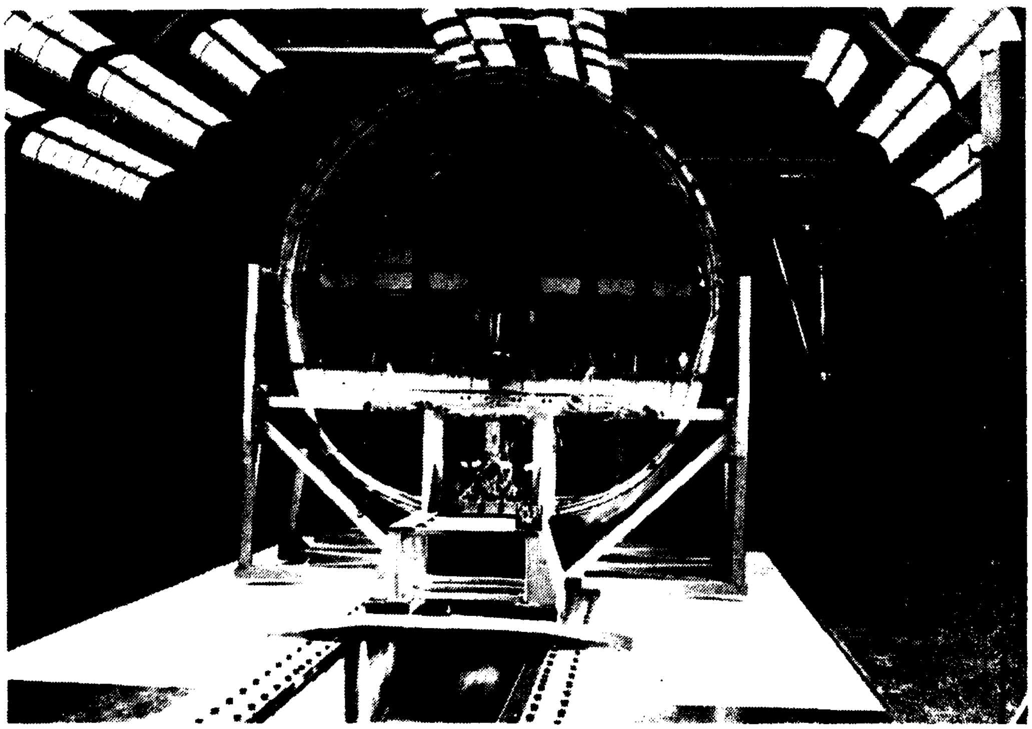


Figure 21 PRE-TEST 01 RIGHT FRONT 3/4 VIEW ?



[illegible]


FAA 001
10 5 87
POST


FAA 001
10 5 87
POST

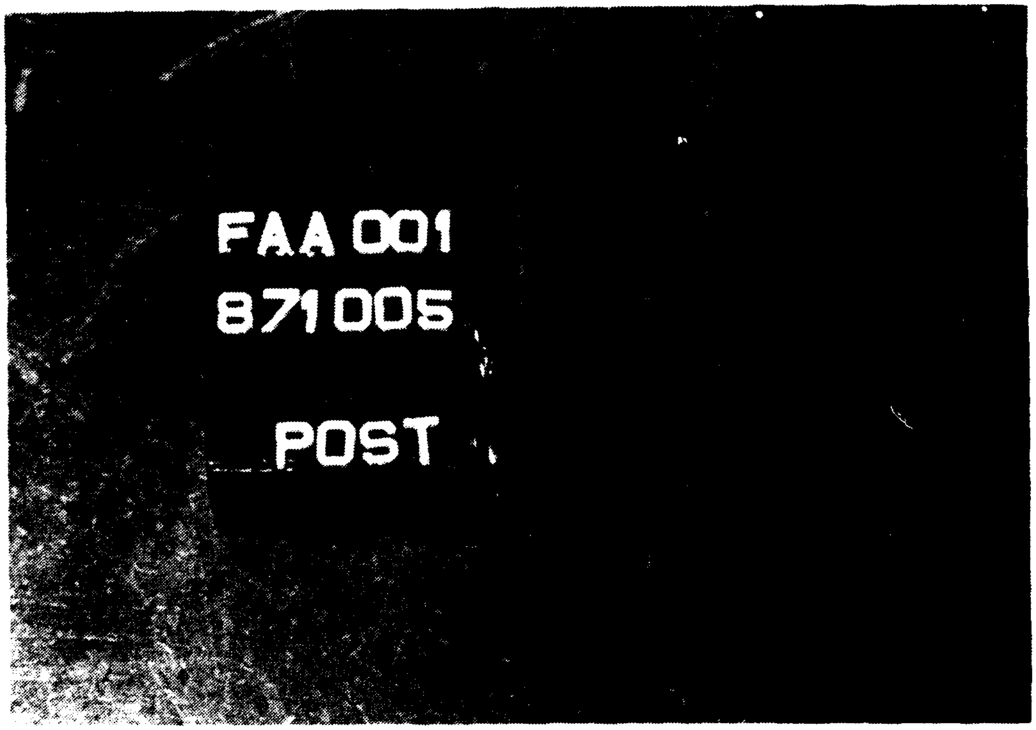


Figure 25. POST-TEST 01 BELT ATTACHMENT BUCKLE

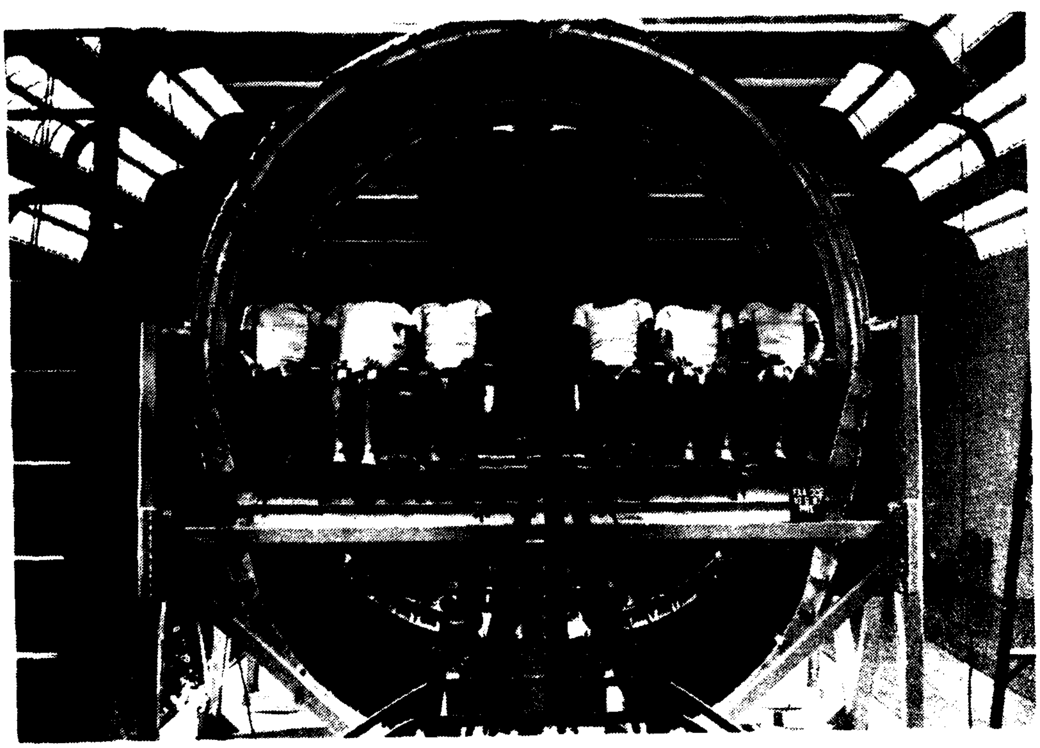


Figure 26. PRE-TEST 02 FRONT [illegible]

[illegible] PRE-TE[illegible]T [illegible] FRONT [illegible]

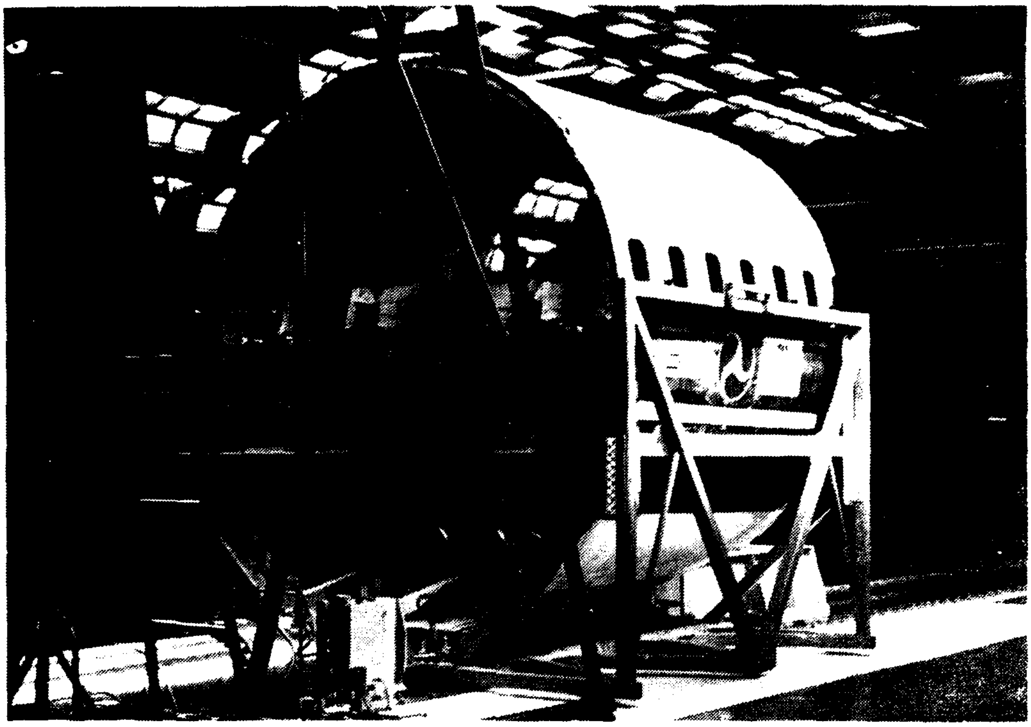
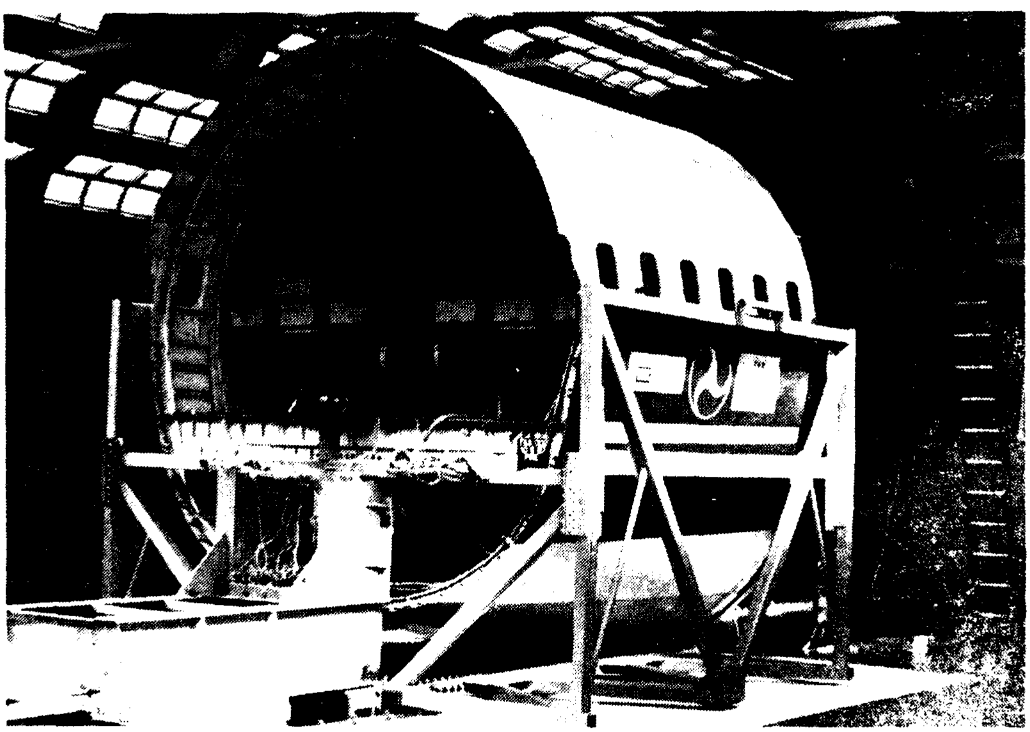
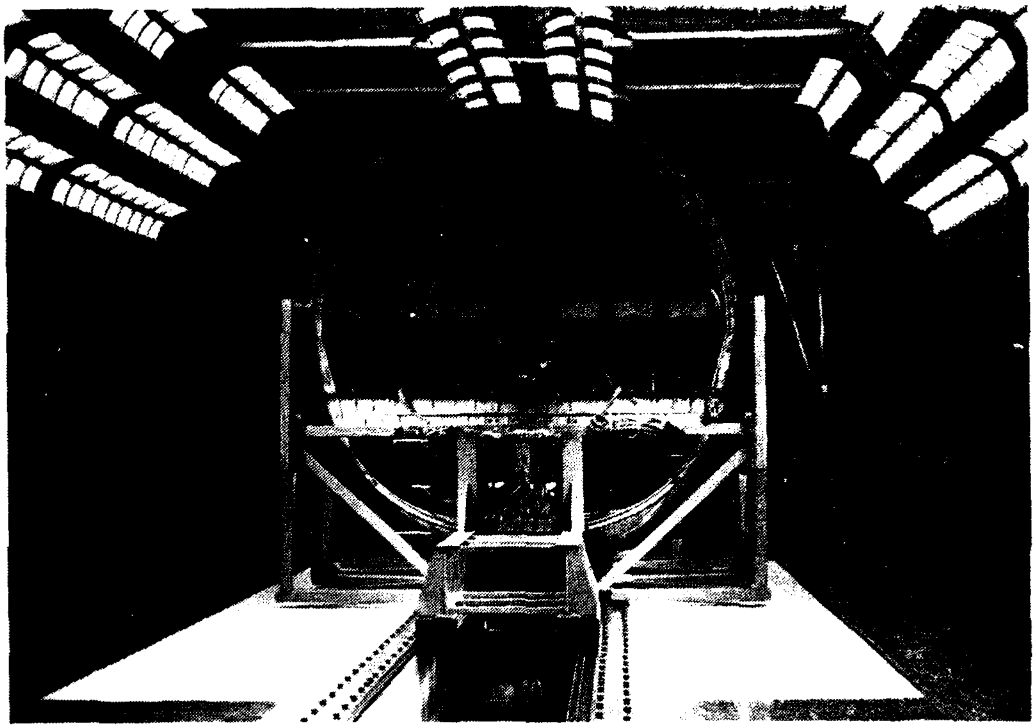


Figure 29. PRE-TEST 02 LEFT FRONT 3/4 VIEW





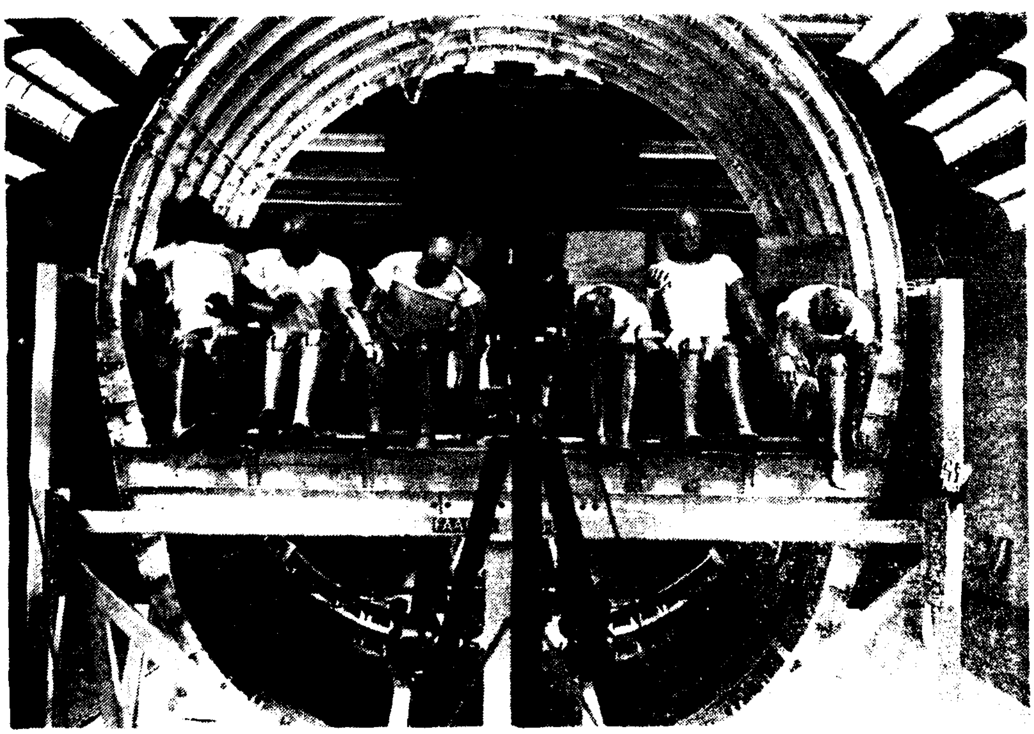


Figure 33. POST-TEST 02 FRONT - VIEW 2

Figure 34. POST-TEST [illegible]

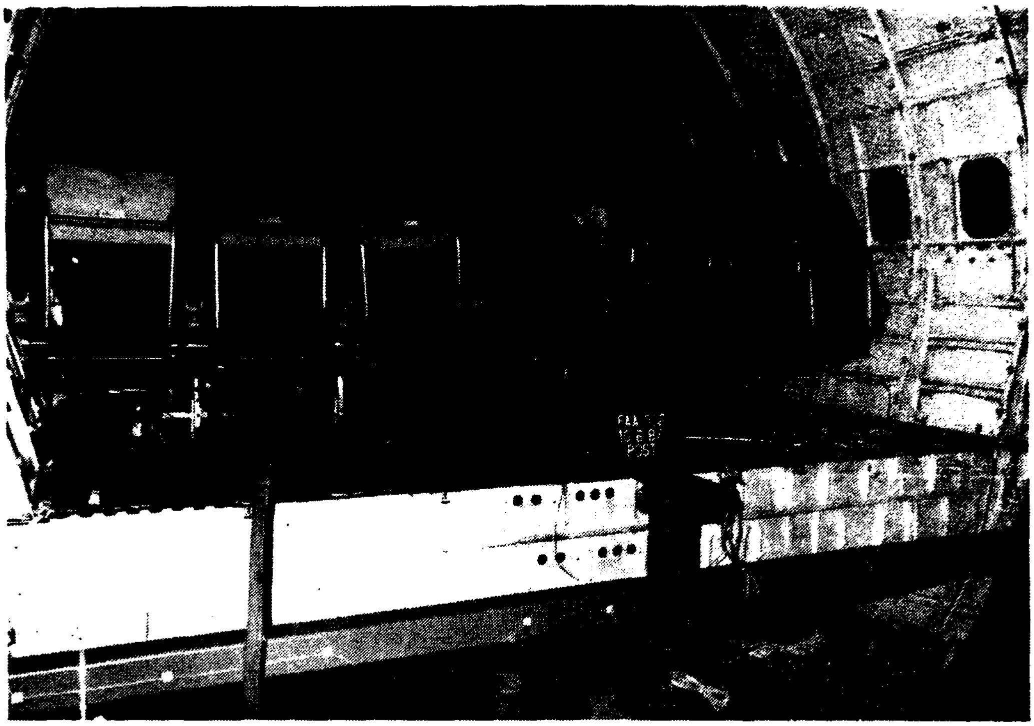


Figure 35. POST TEST 02 REAR VIEW

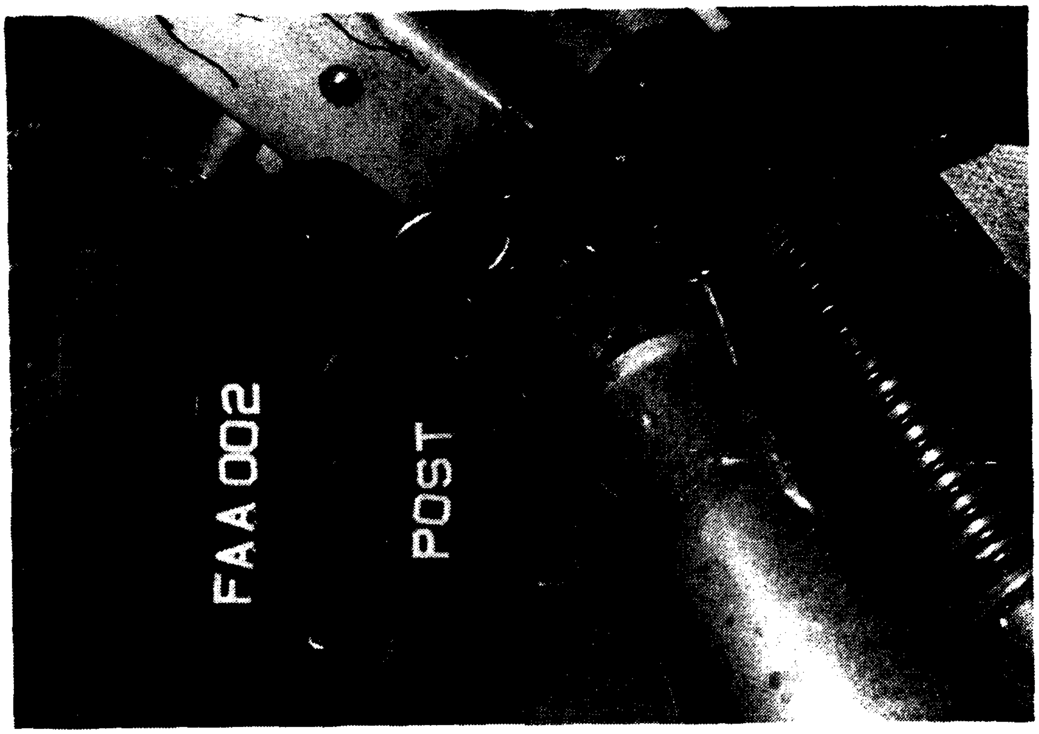


Figure 37. POST-TEST 02 TUBE BUCKLING


FAA 002
10 6 87
POST


FAA 002
10 6 87
POST

Figure 41   POST-TEST 02 REAR CROSS TUBE

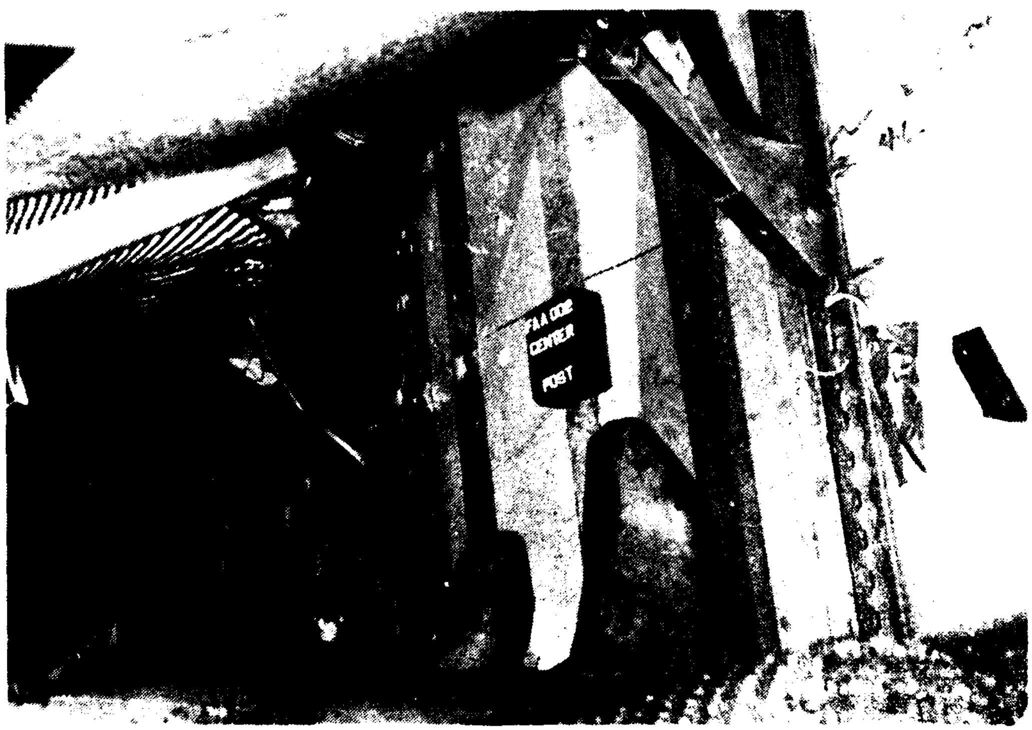


Figure 4[illegible]. POST TEST OF SECOND ROW LEFT IN[illegible]

Figure 44. POST TEST [illegible]

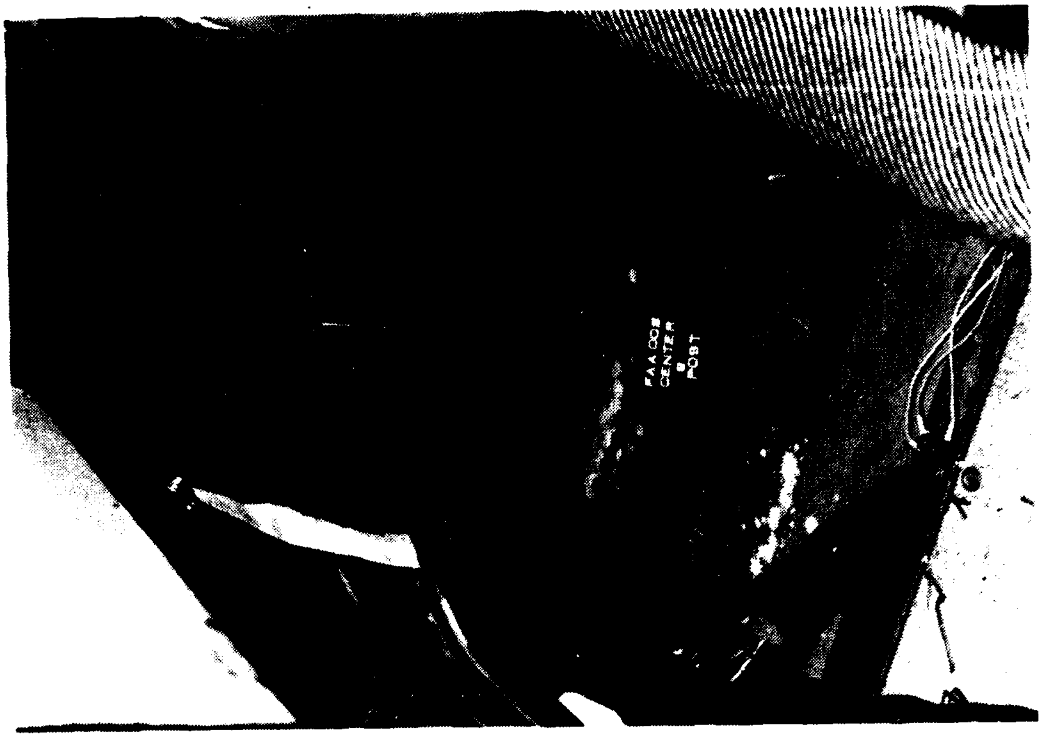
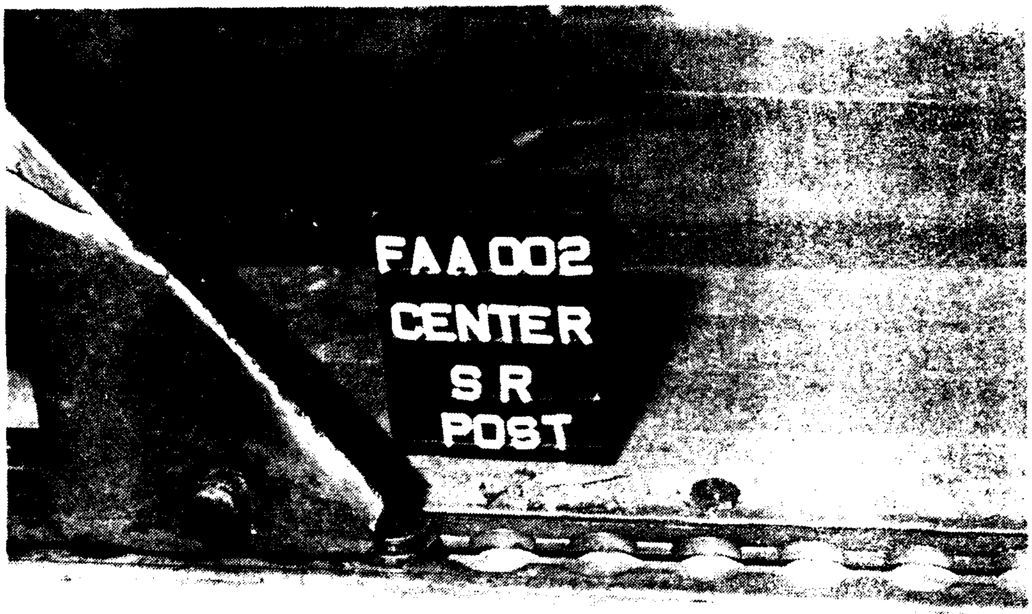


Figure 45. POST TEST 02 SECOND ROW RIGHT SIDE SEAT [illegible]


FAA 002
CENTER
S R
POST

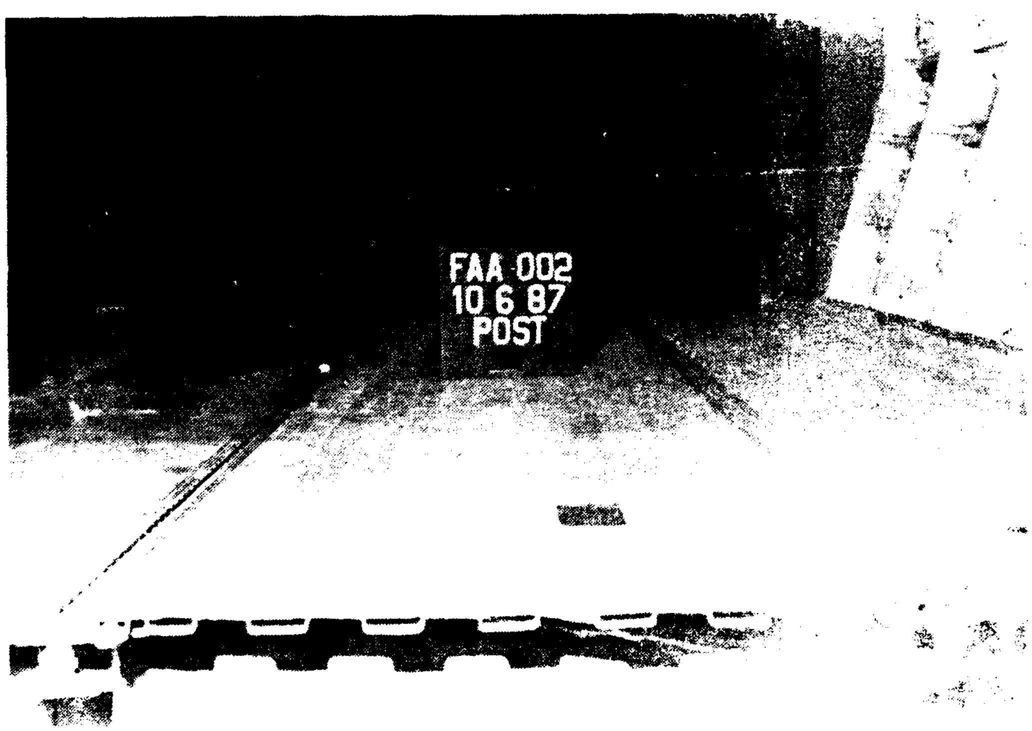

FAA 002
10 6 87
POST

Figure 43. POST-TEST 02 FLOOR (VIEW [illegible])

Figure 11 POST-TEST 02 FLOOR VIEW 4

DUMMY AND SEAT BELT INSTRUMENTATION LIST

CHANNEL ABBREVIATION	CHANNEL TITLE	INSTRUMENT MANUFACTURER	INSTRUMENT SERIAL NO.
PEVXG1	SEAT D CENTER DUMMY PELVIS LONGITUDINAL ACCEL.	ENDEVCO 7264	CC77H
PEVZG1	SEAT D CENTER DUMMY PELVIS VERTICAL ACCEL.	ENDEVCO 7264	CB07H
PEVXG2	SEAT C CENTER DUMMY PELVIS LONGITUDINAL ACCEL.	ENDEVCO 7264	BK96J
PEVZG2	SEAT C CENTER DUMMY PELVIS VERTICAL ACCEL.	ENDEVCO 7264	BY82J
LBOF1	SEAT D CENTER DUMMY OUTBOARD LAP BELT LOAD	LEBOW 3419	127
LBIF1	SEAT D CENTER DUMMY INBOARD LAP BELT LOAD	LEBOW 3419	236
LBOF2	SEAT C CENTER DUMMY OUTBOARD LAP BELT LOAD	LEBOW 3419	234
LBIF2	SEAT C CENTER DUMMY INBOARD LAP BELT LOAD	LEBOW 3419	718

FUSELAGE INSTRUMENTATION LIST

CHANNEL ABBREVIATION	INSTRUMENT MANUFACTURER	INSTRUMENT SERIAL NO.	INSTRUMENT BODY STATION	LOCATION LATERAL*	LOCATION VERTICAL*
FUSXG1	ENDEVCO 7264	CF11H	1180	-63.9	54.5
FUSXG2	ENDEVCO 7264	CE23H	1180	0.0	95.7
FUSXG3	ENDEVCO 7264	CD74H	1180	63.9	54.5
FLMXG1	ENDEVCO 7264	CE49H	1180	-24.75	0.0
FLAXG2	ENDEVCO 7264	CE79H	1240	24.75	0.0
FLAYG2	ENDEVCO 7264	CA57H	1240	24.75	0.0
FLAZG2	ENDEVCO 7264	CC01H	1240	24.75	0.0
FLMXG3	ENDEVCO 7264	CE63H	1180	24.75	0.0
FLMYG3	ENDEVCO 7264	CC02H	1180	24.75	0.0
FLMZG3	ENDEVCO 7264	BY18J	1180	24.75	0.0
FLFXG4	ENDEVCO 7264	CE72H	1120	24.75	0.0
FLFYG4	ENDEVCO 7264	CE91H	1120	24.75	0.0
FLFZG4	ENDEVCO 7264	CE21H	1120	24.75	0.0
POBS	STRAIN GAGE		1180	-45.5	-0.7
PIBS	STRAIN GAGE		1180	-24.75	-0.7
SIBS	STRAIN GAGE		1180	24.75	-0.7
SOBS	STRAIN GAGE		1180	45.5	-0.7
POSTZD	STRING POT		1180	-45.5	-8.0
PISTZD	STRING POT		1180	-24.75	-8.0
SISTZD	STRING POT		1180	24.75	-8.0
SOSTZD	STRING POT		1180	45.5	-8.0
POSTCD	CRACK DETECTOR		1120-1240	-45.50	0.0
PISTCD	CRACK DETECTOR		1120-1240	-24.75	0.0
SISTCD	CRACK DETECTOR		1120-1240	24.75	0.0
SOSTCD	CRACK DETECTOR		1120-1240	45.50	0.0
CBCD	CRACK DETECTOR		1180	-70.5-70.5	-0.7

*REFERENCE AND SIGN CONVENTION

		POSITIVE	NEGATIVE
LATERAL:	FUSELAGE CENTERLINE	RIGHT	LEFT
VERTICAL:	TOP OF FLOOR	UP	DOWN

SEAT INSTRUMENTATON LIST

CHANNEL ABBREVIATION	CHANNEL TITLE	INSTRUMENT MANUFACTURER	[illegible]
[illegible]	SEAT C LONGITUDINAL ACCELERATION	ENTRAN	A1 [illegible]
[illegible]	SEAT C LATERAL ACCELERATION	ENTRAN	A2 [illegible]
SECZG	SEAT C VERTICAL ACCELERATION	ENTRAN	[illegible]
SEDXG	SEAT D LONGITUDINAL ACCELERATION	ENTRAN	[illegible]3-3
SEDYG	SEAT D LATERAL ACCELERATION	ENTRAN	[illegible]
SEDZG	SEAT D VERTICAL ACCELERATION	ENTRAN	[illegible]
SAOFLS	SEAT A OUTBOARD FORWARD LEG STRAIN	STRAIN GAGE	[illegible]
SBIFLS	SEAT B INBOARD FORWARD LEG STRAIN	STRAIN GAGE	[illegible]
SCOFLS	SEAT C OUTBOARD FORWARD LEG STRAIN	STRAIN GAGE	[illegible]
SCODSS	SEAT C OUTBOARD DIAGONAL STRUT STRAIN	STRAIN GAGE	[illegible]
[illegible]	SEAT C INBOARD FORWARD LEG STRAIN	STRAIN GAGE	[illegible]
[illegible]	SEAT C INBOARD DIAGONAL STRUT STRAIN	STRAIN GAGE	[illegible]
[illegible]	SEAT D OUTBOARD FORWARD LEG STRAIN	STRAIN GAGE	[illegible]
[illegible]	SEAT D OUTBOARD DIAGONAL STRUT STRAIN	STRAIN GAGE	[illegible]
[illegible]	SEAT D INBOARD FORWARD LEG STRAIN	STRAIN GAGE	[illegible]
[illegible]	SEAT D INBOARD DIAGONAL STRUT STRAIN	STRAIN GAGE	[illegible]

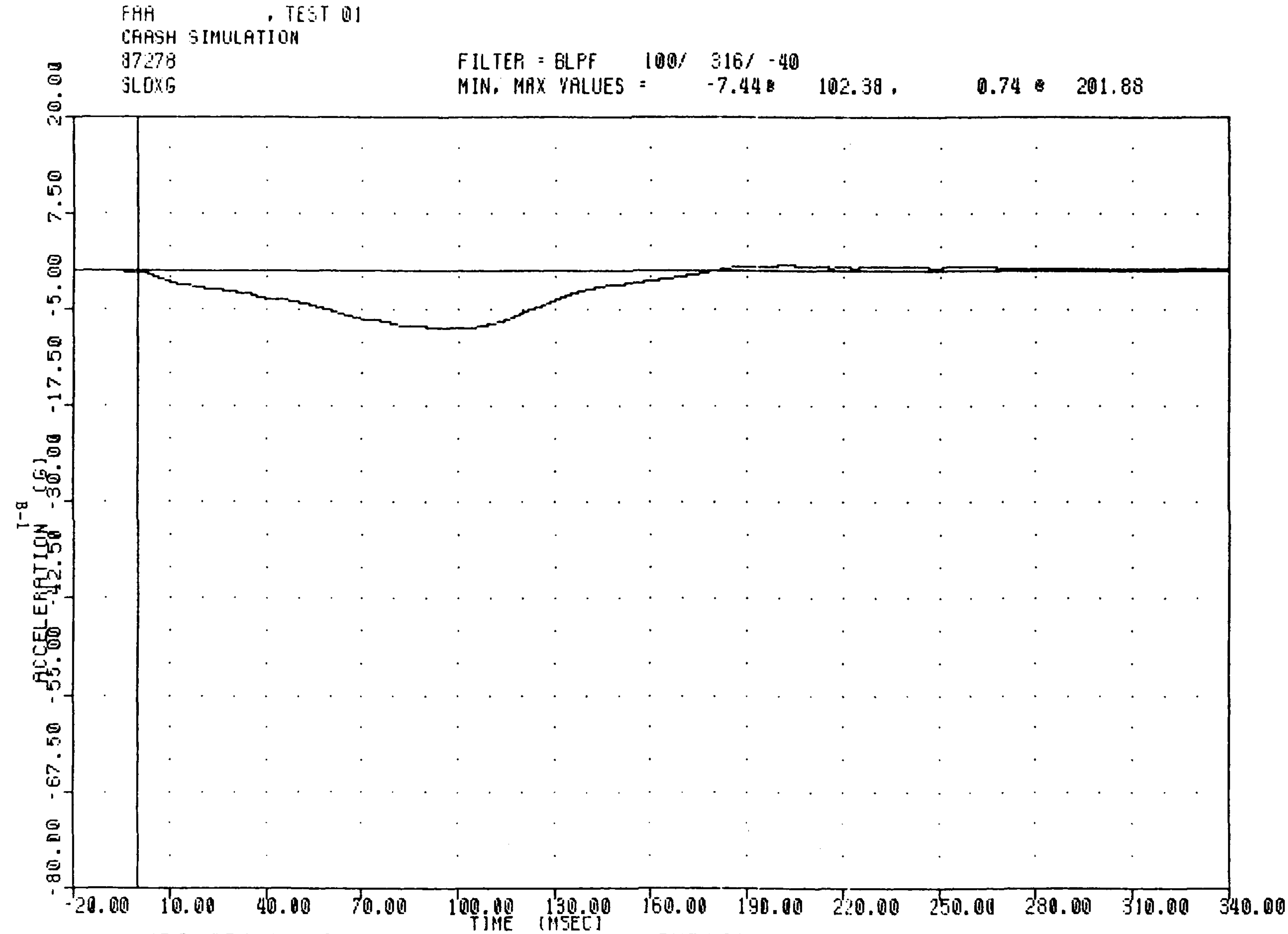
SEAT INSTRUMENTATON LIST

CHANNEL ABBREVIATION	CHANNEL TITLE	INSTRUMENT MANUFACTURER	INSTRUMENT SERIAL NO.
SEODSS	SEAT E OUTBOARD DIAGONAL STRUT STRAIN	STRAIN GAGE	A87087-02
SAODSS	SEAT A OUTBOARD DIAGONAL STRUT STRAIN	STRAIN GAGE	A87084-02
SEOFLS	SEAT E OUTBOARD FORWARD LEG STRAIN	STRAIN GAGE	A87087-01
SFOFLS	SEAT F OUTBOARD FORWARD LEG STRAIN	STRAIN GAGE	A87089-04

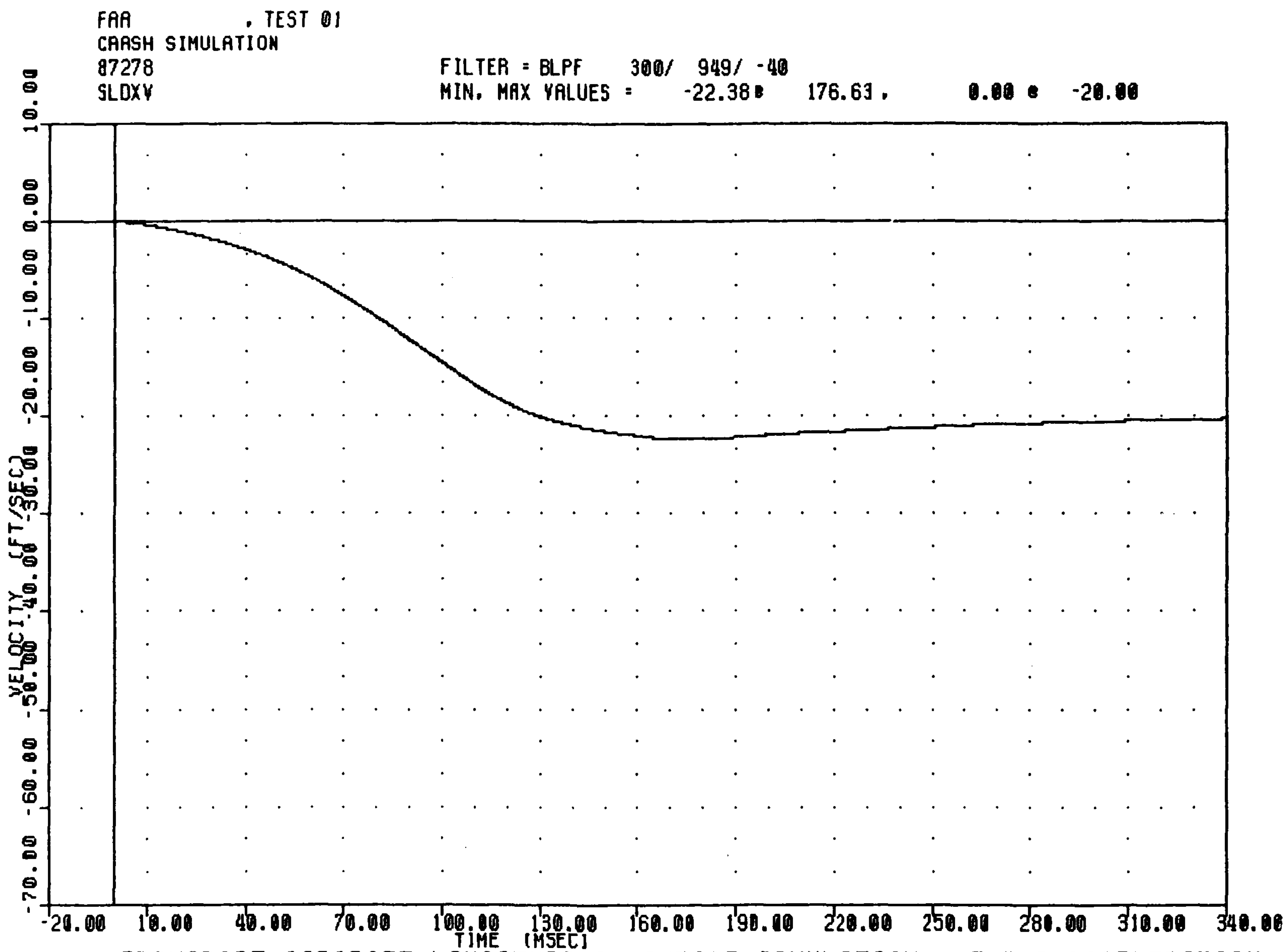
APPENDIX B

DATA PLOTS

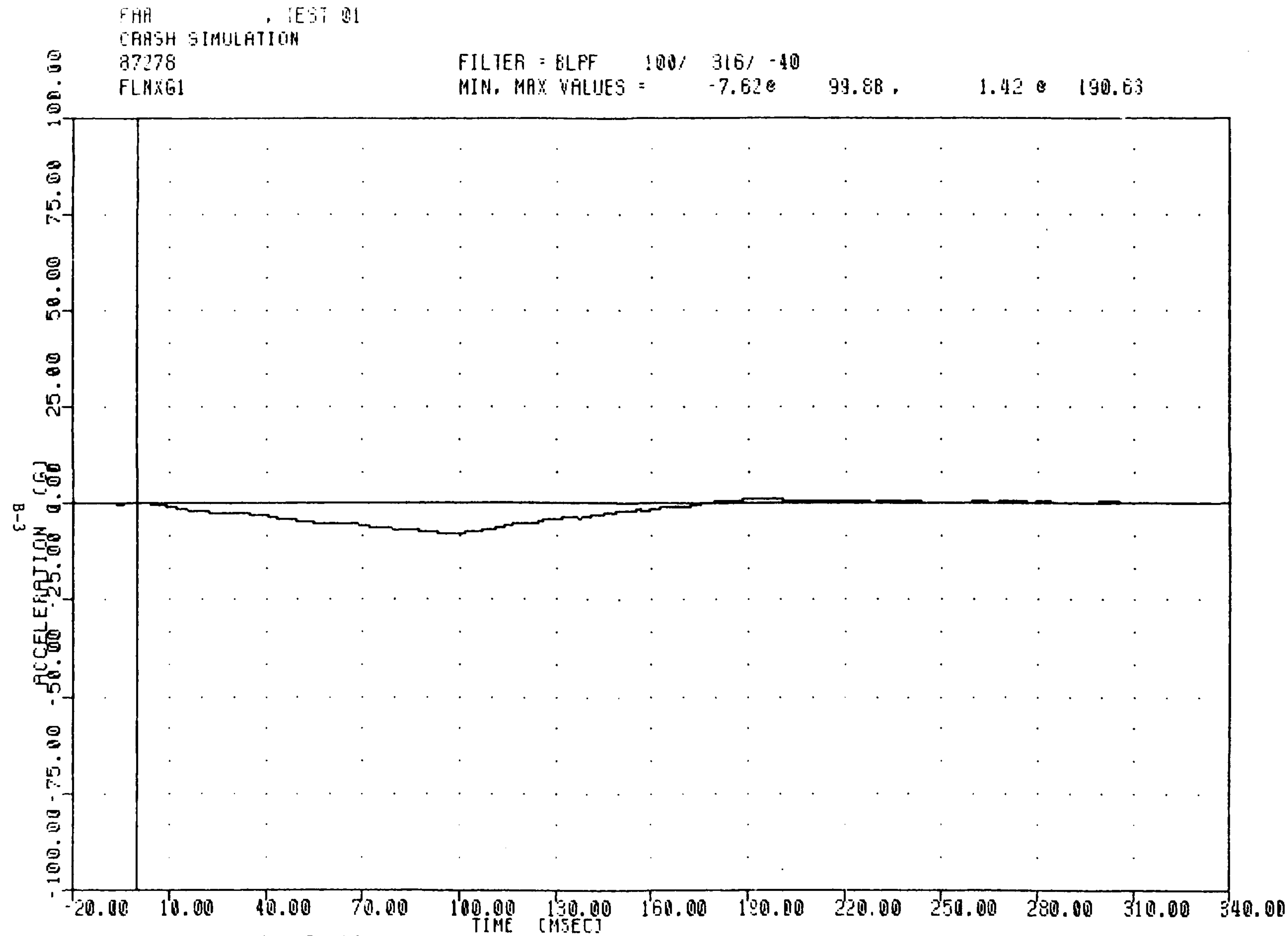
TESTS 01 AND 02



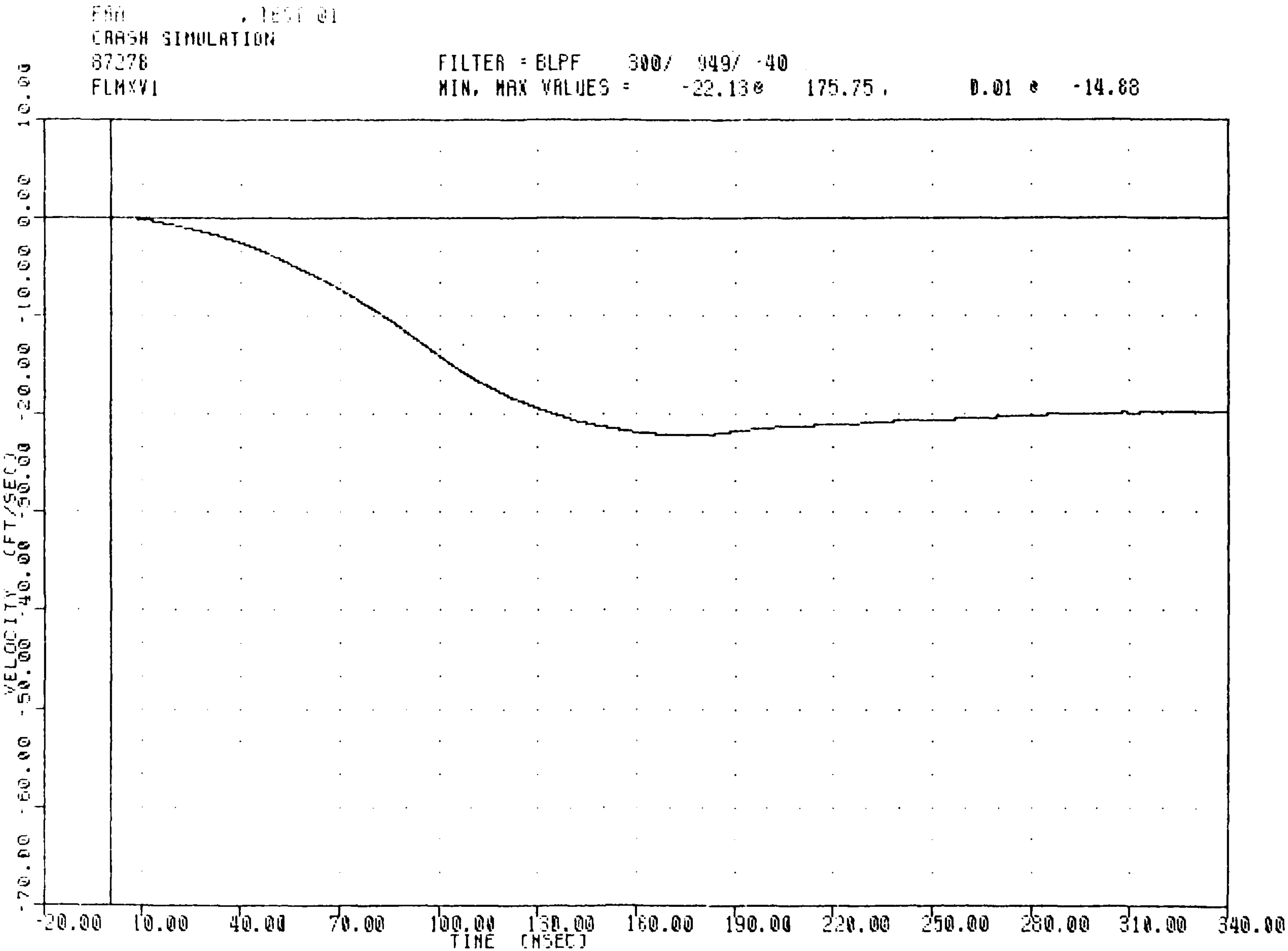
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SLED LONGITUDINAL ACCELERATION



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SLED LONGITUDINAL VELOCITY



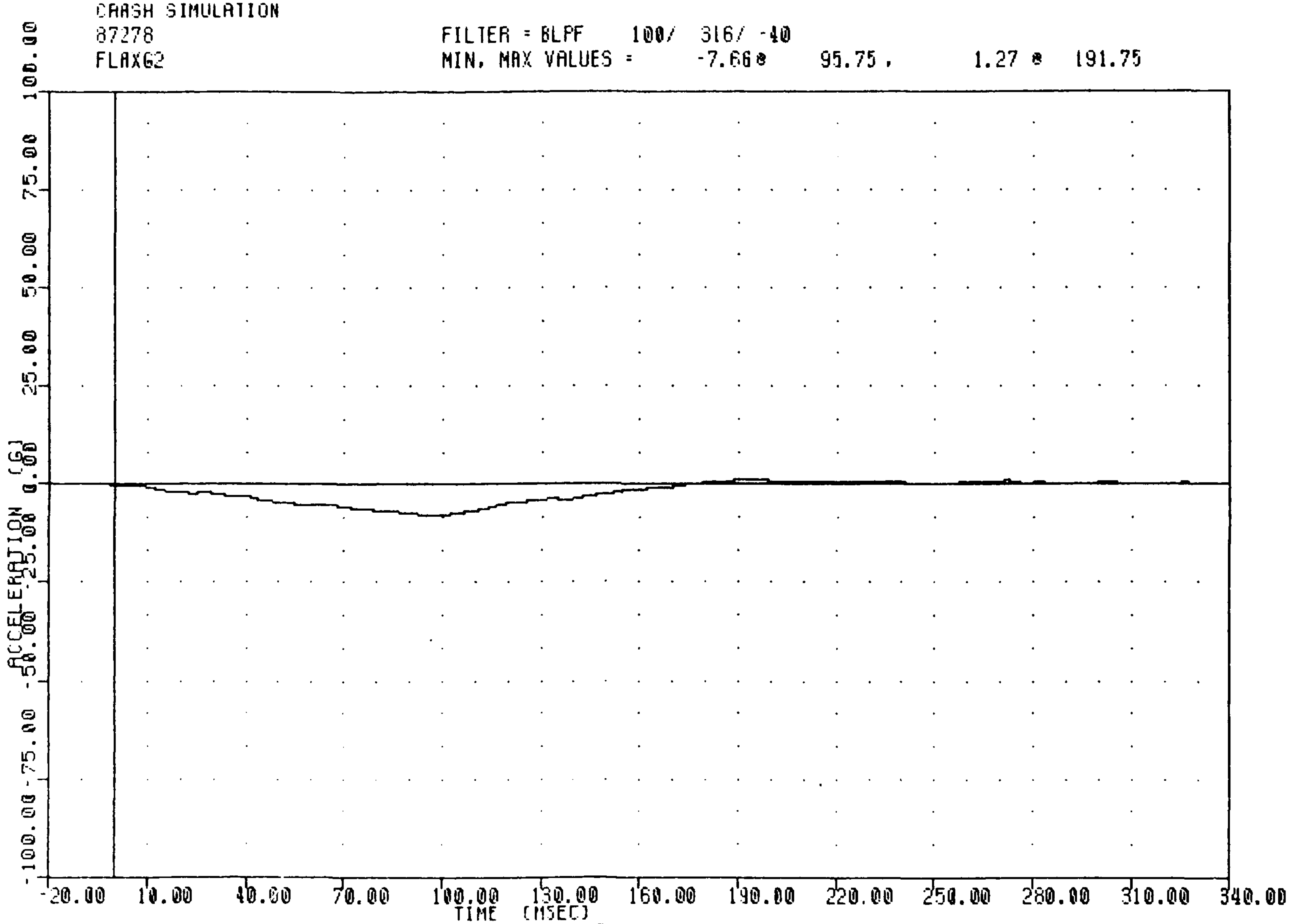
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
PORT INBOARD SEAT TRACK LONGITUDINAL ACCELERATION - MID



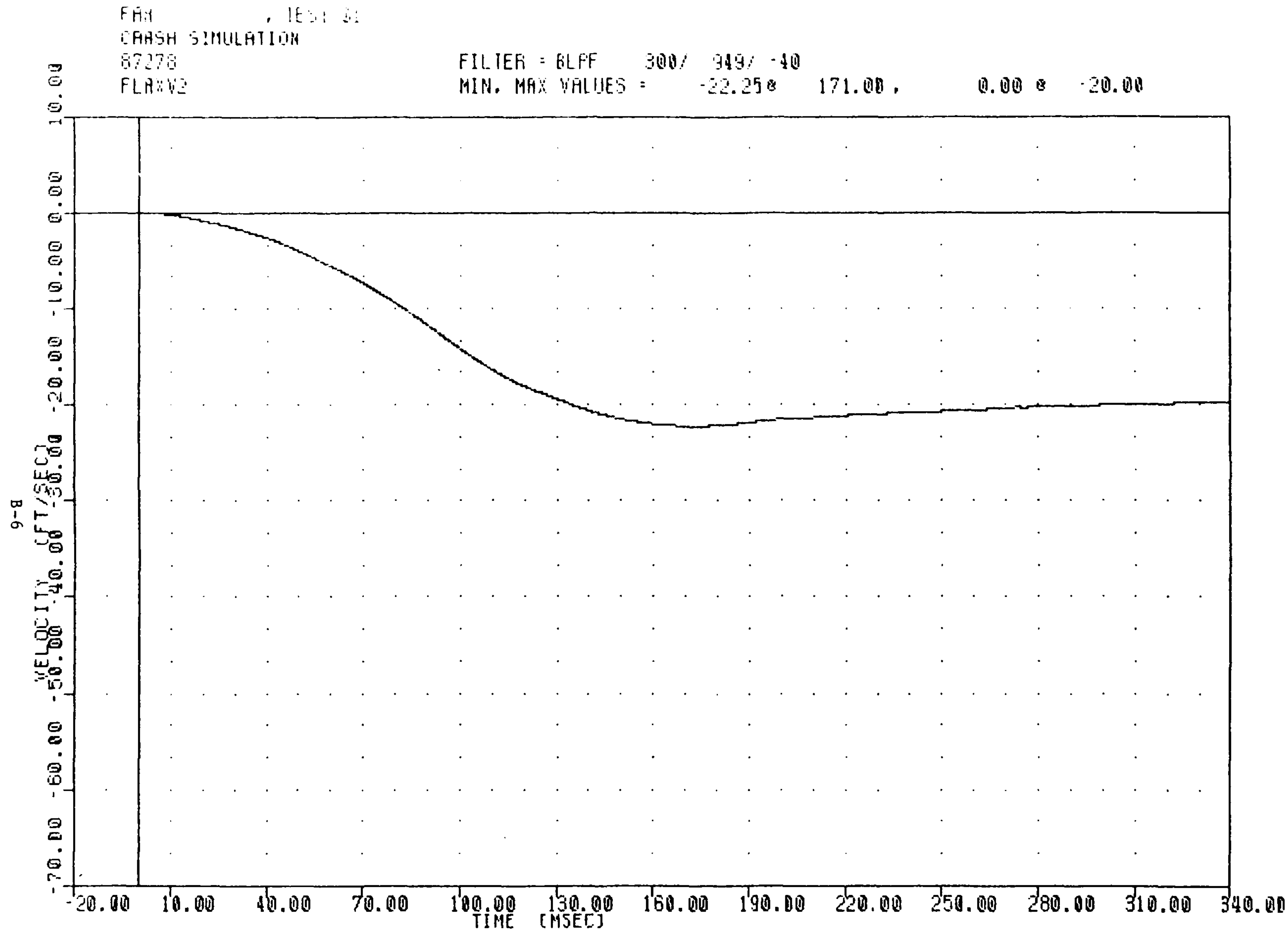
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
PORT INBOARD SEAT TRACK LONGITUDINAL VELOCITY - MID

FAA . TEST 01
CRASH SIMULATION
87278
FLAX62

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -7.66 @ 95.75 , 1.27 @ 191.75



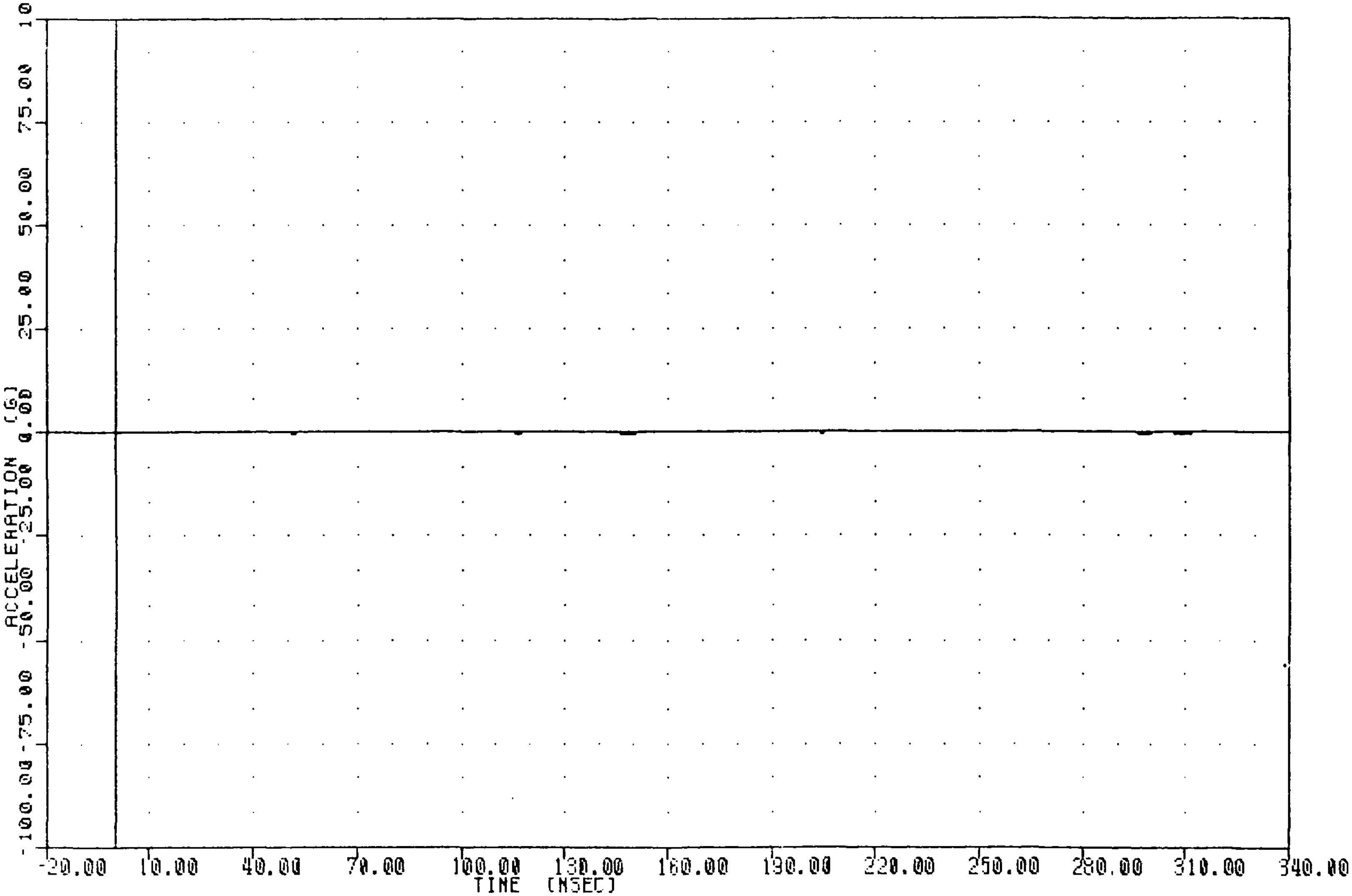
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD SEAT TRACK LONGITUDINAL ACCELERATION - AFT



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD SEAT TRACK LONGITUDINAL VELOCITY - AFT

FAA , TEST 01
CRASH SIMULATION
8727B
FLAY62

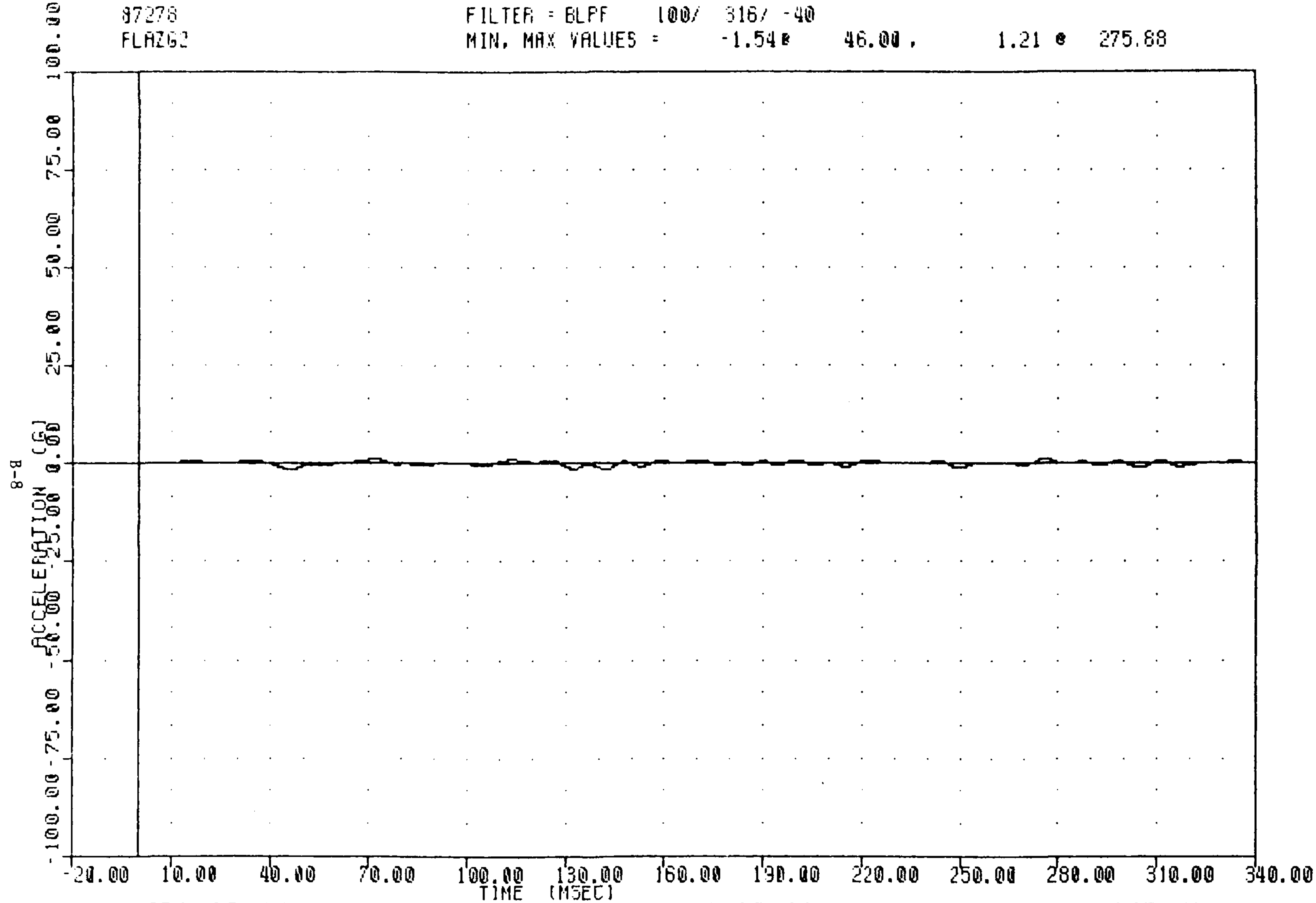
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.28 @ 148.13 , 0.25 @ 253.25



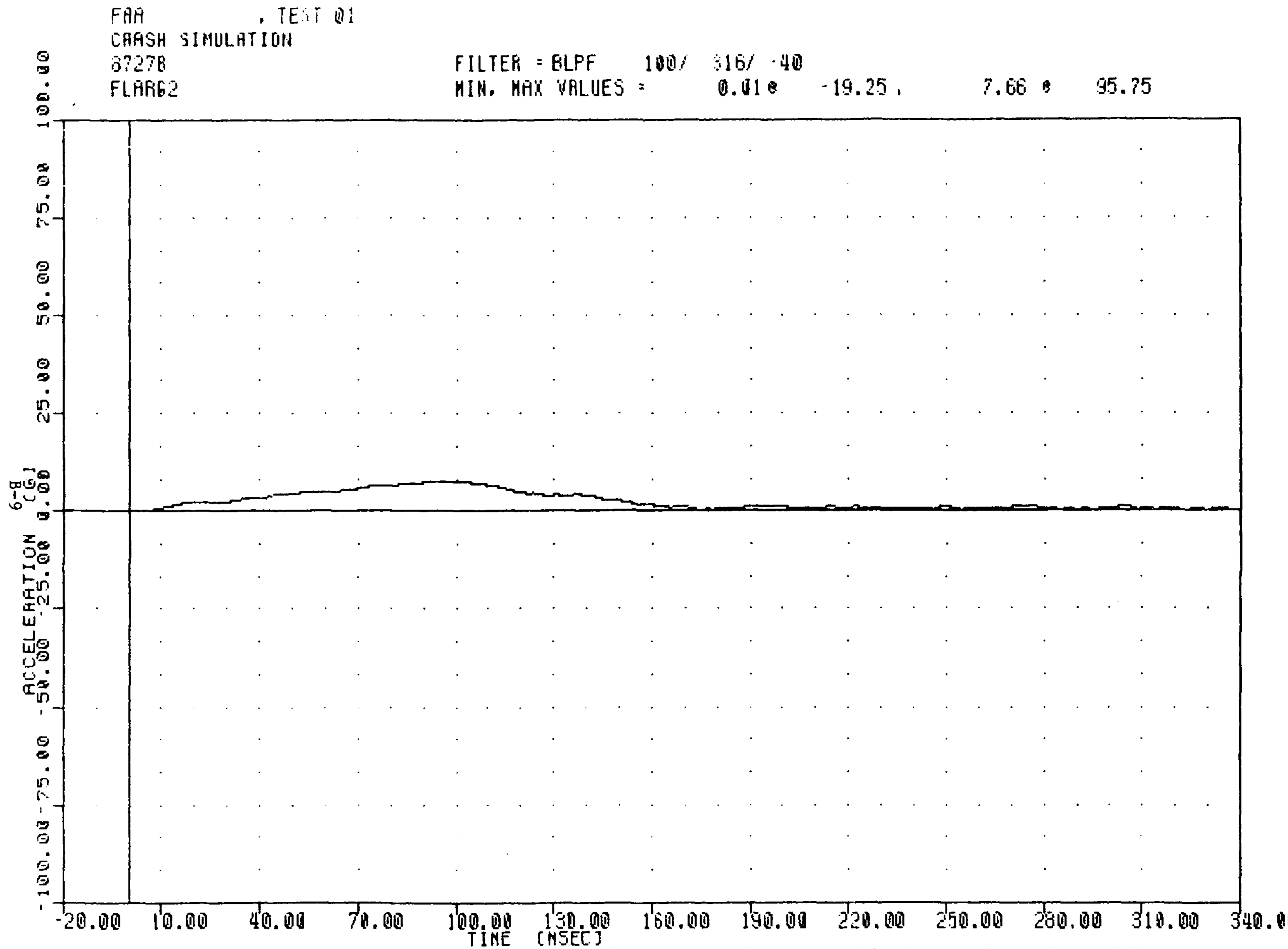
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD SEAT TRACK LATERAL ACCELERATION - AFT

FAA , TEST 01
CRASH SIMULATION
87278
FLAZ62

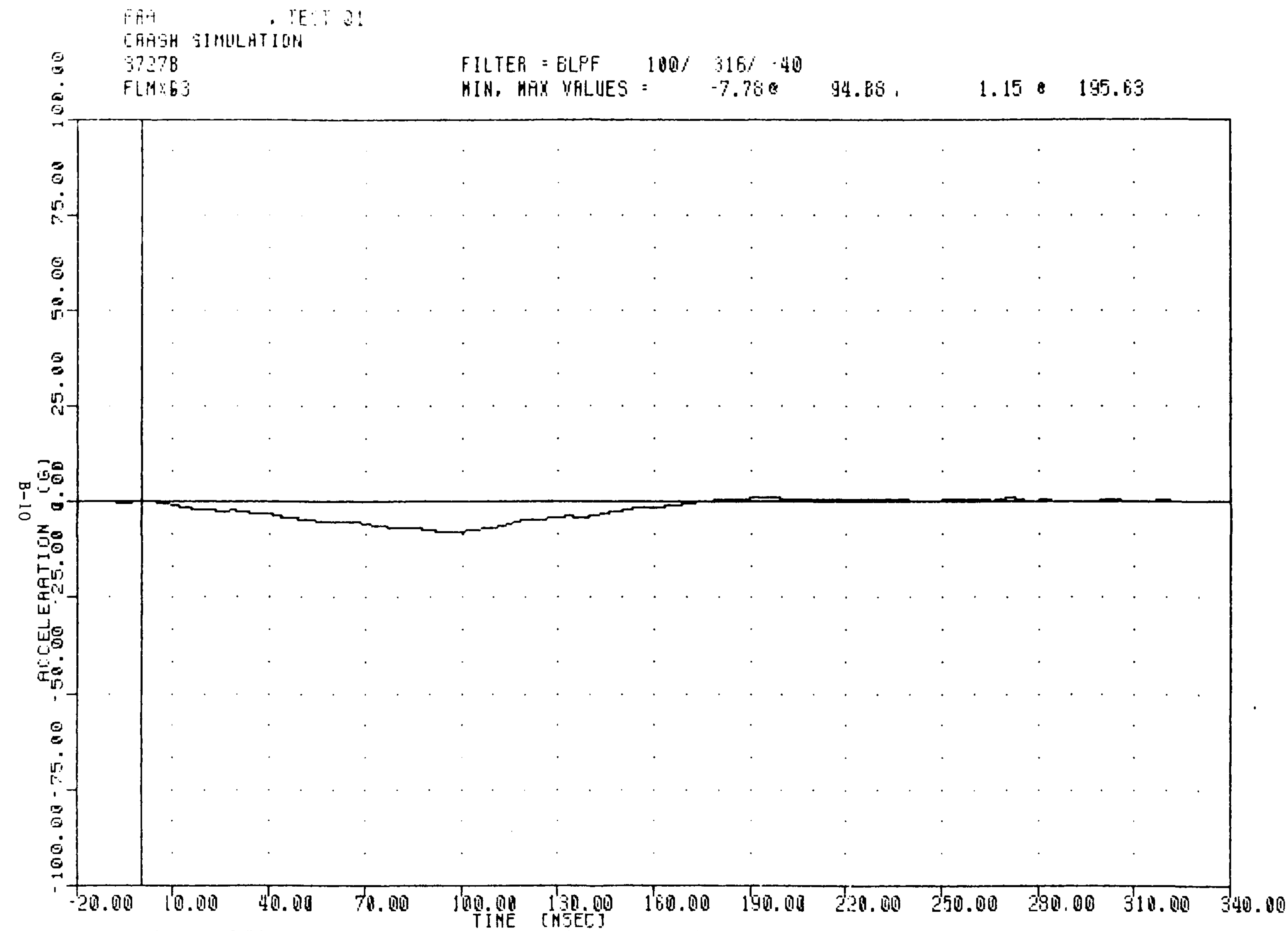
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -1.54 @ 46.00 , 1.21 @ 275.88



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD SEAT TRACK VERTICAL ACCELERATION - AFT



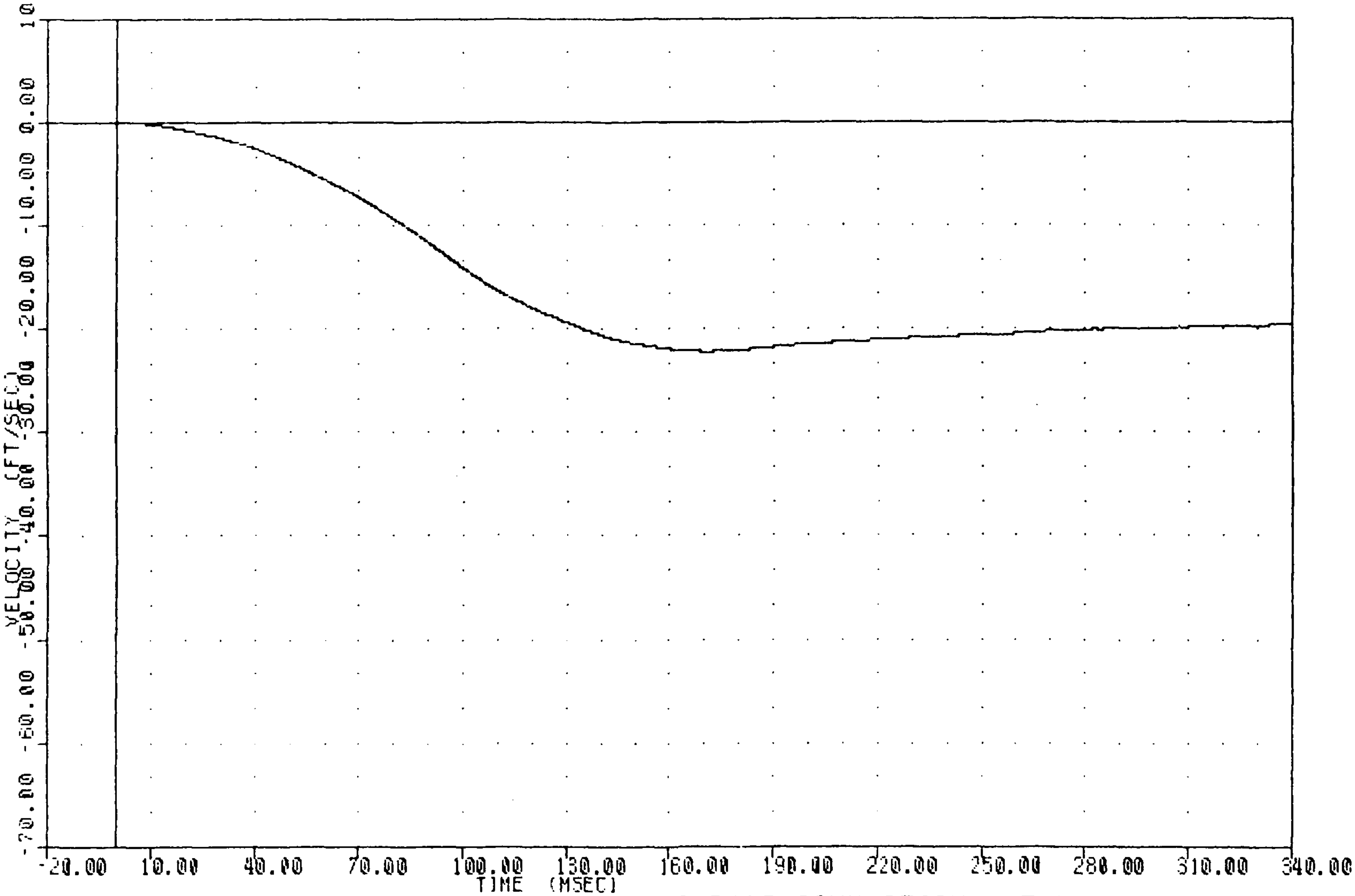
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD SEAT TRACK ACCELERATION - AFT RESULTANT



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD SEAT TRACK LONGITUDINAL ACCELERATION - MID

FAA , TEST 01
CRASH SIMULATION
87278
FLMXV3

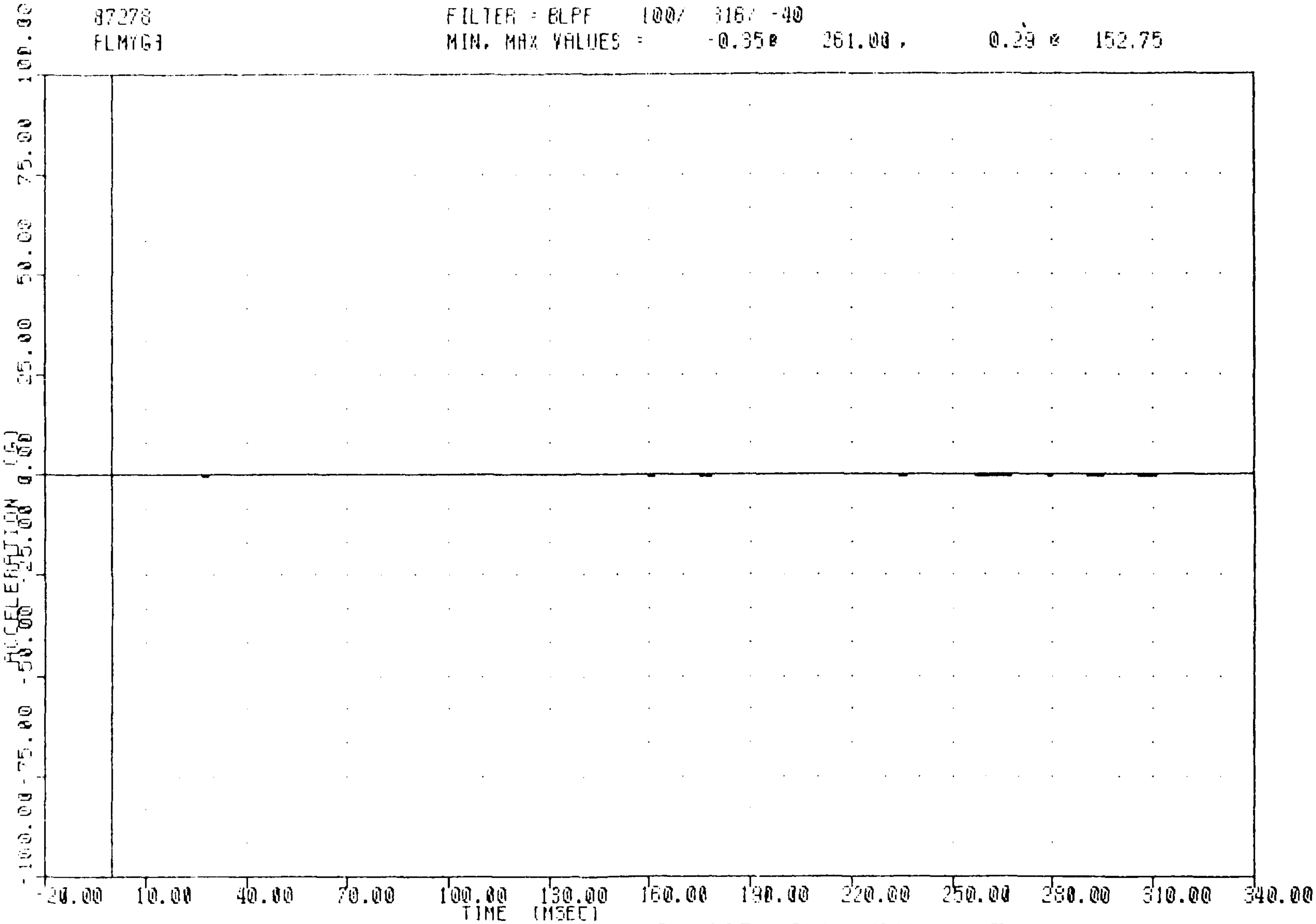
FILTER = BLPF 300/ 949/ -40
MIN. MAX VALUES = -22.21 @ 170.83 , 0.01 @ -15.33



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD SEAT TRACK LONGITUDINAL VELOCITY - MID

FAA . 1551 01
CRASH SIMULATION
87278
FLMYG3

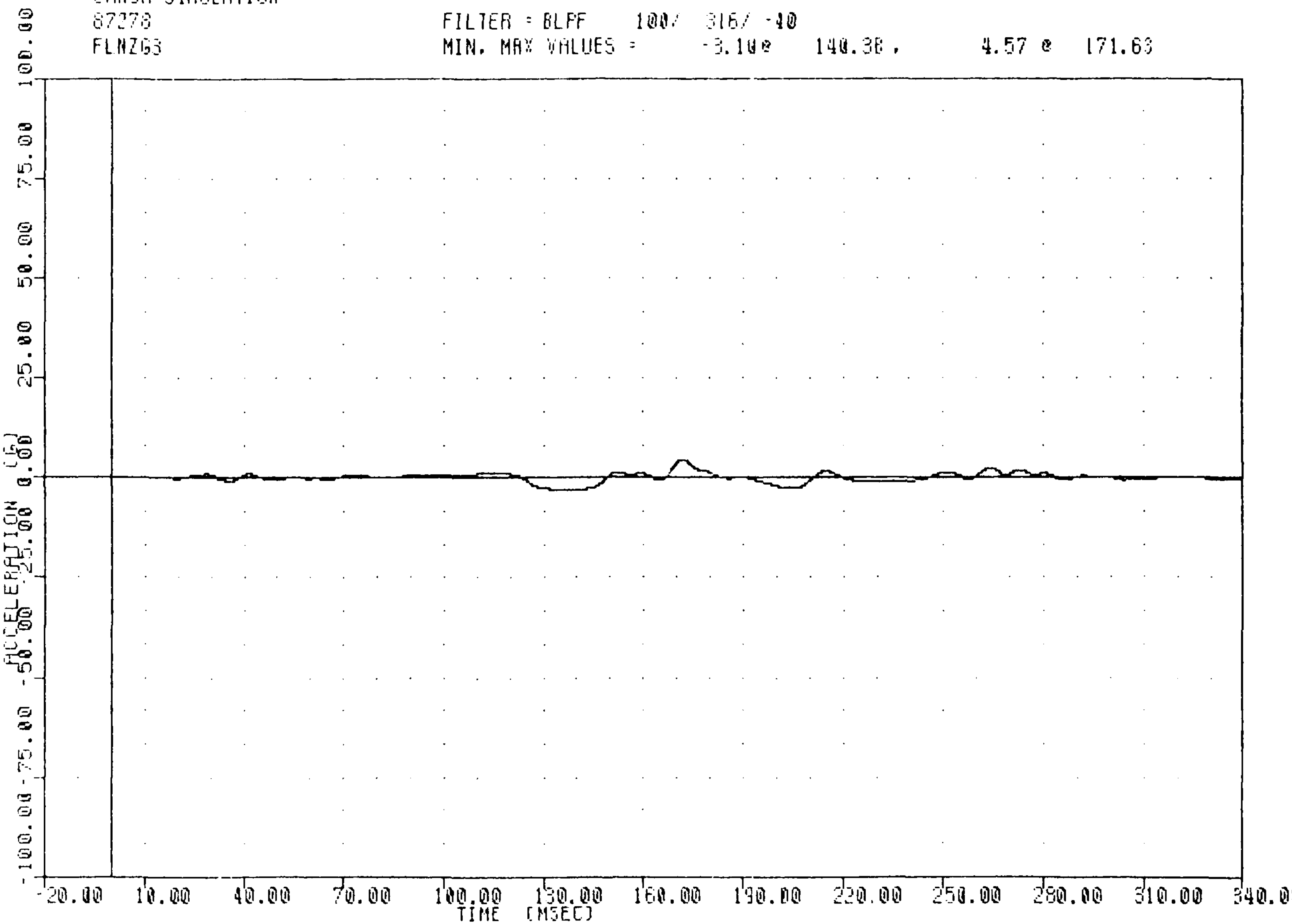
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.35 @ 261.00 , 0.29 @ 152.75



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD SEAT TRACK LATERAL ACCELERATION - MID

FAA , TEST 01
CRASH SIMULATION
87278
FLNZ63

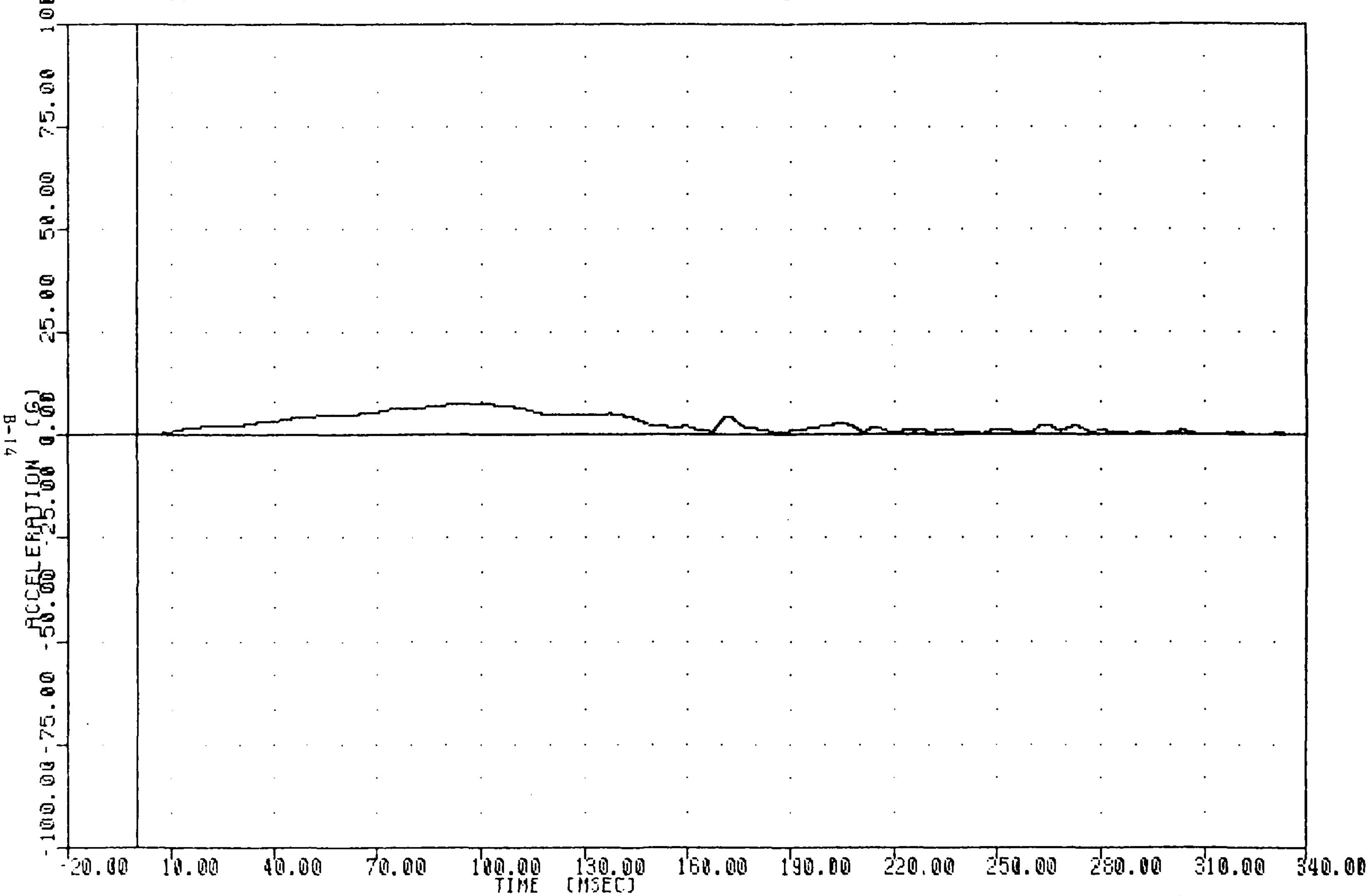
FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -3.10 @ 140.38 , 4.57 @ 171.63



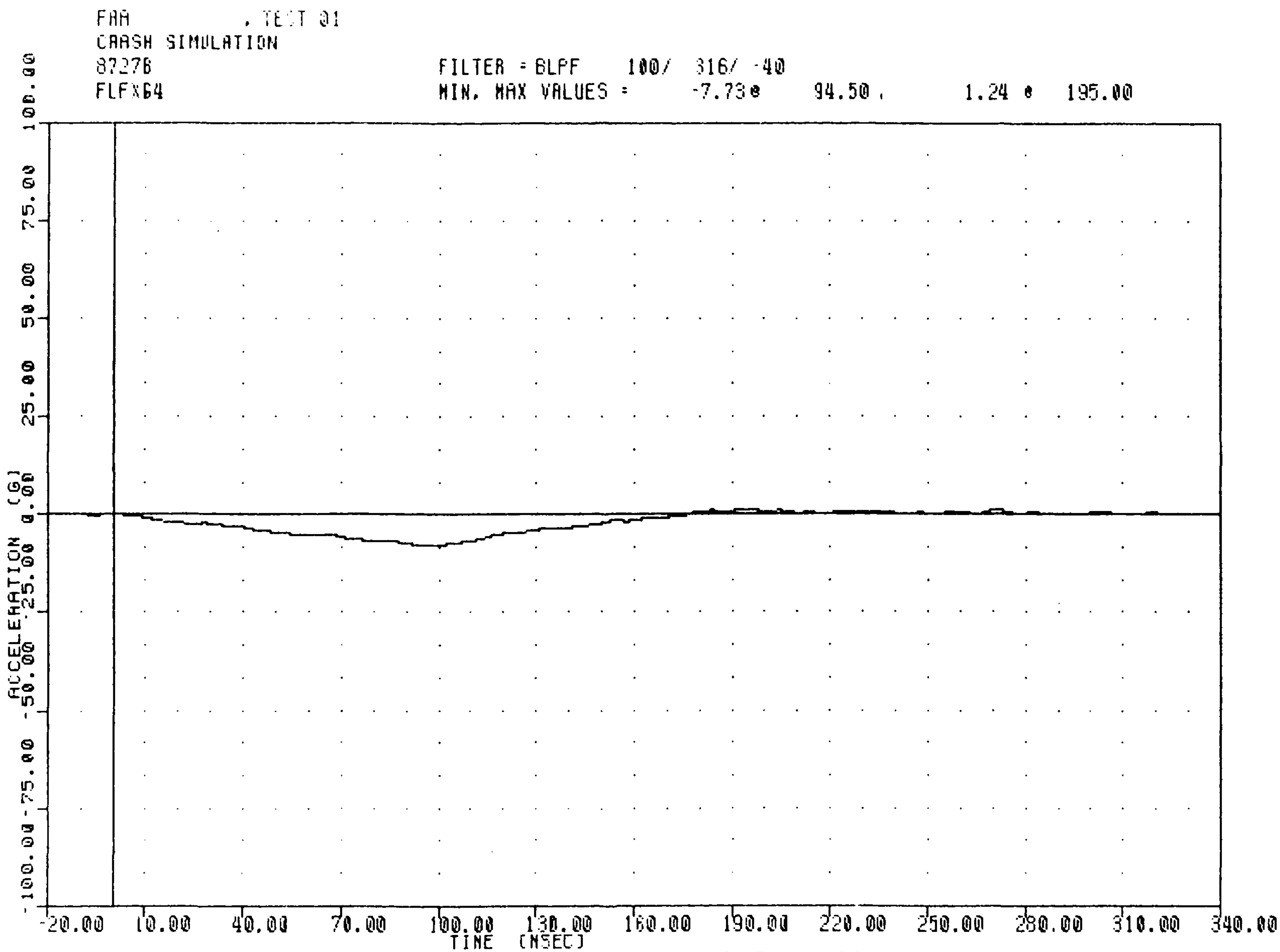
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD SEAT TRACK VERTICAL ACCELERATION - MID

FAA , TEST 01
CRASH SIMULATION
87278
FLNRG3

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = 0.04 @ -11.63 , 7.81 @ 94.75



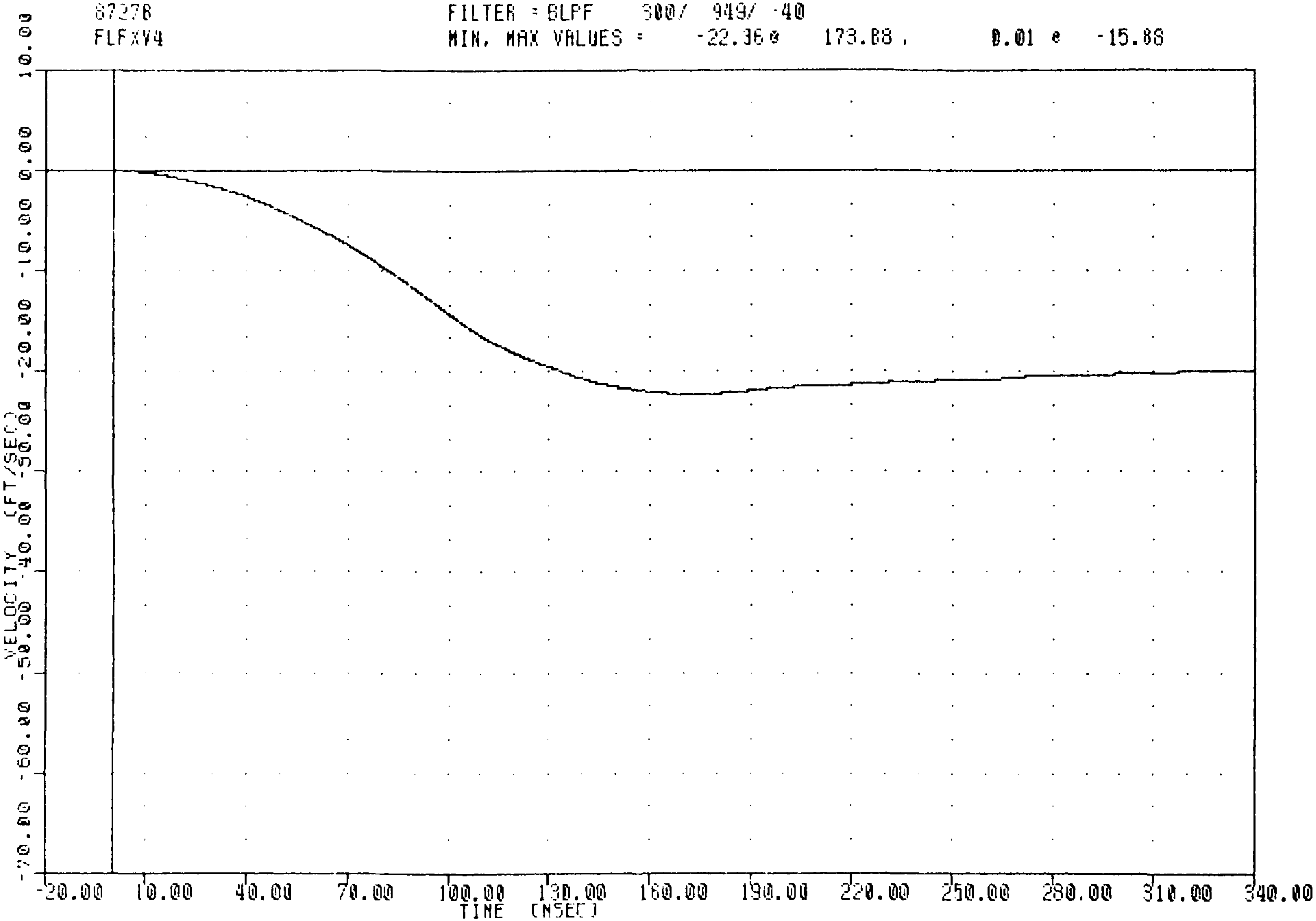
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD SEAT TRACK ACCELERATION - MID RESULTANT



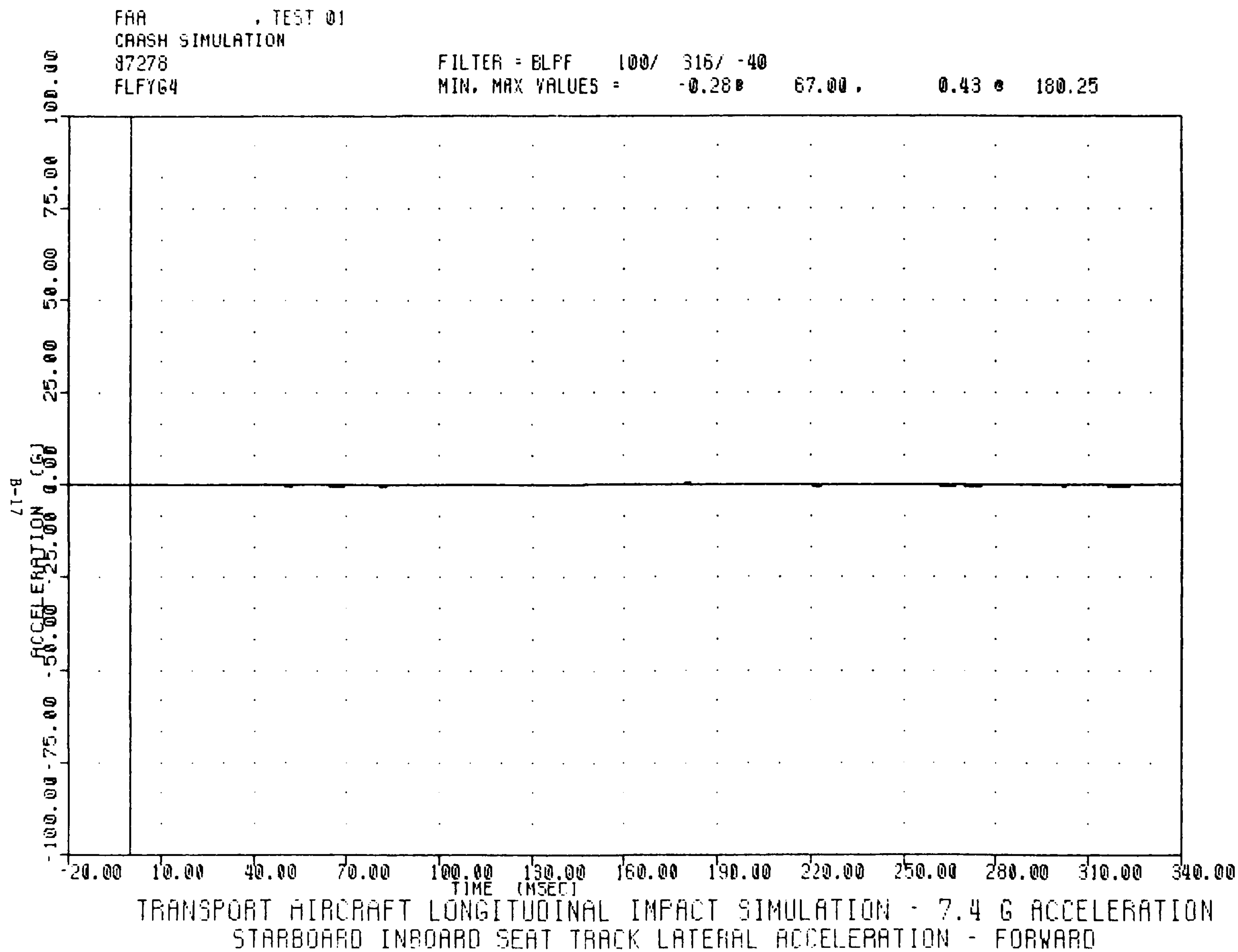
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD SEAT TRACK LONGITUDINAL ACCELERATION - FORWARD

FAA , TEST 01
CRASH SIMULATION
87278
FLFXV4

FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -22.36 @ 173.88 , 0.01 @ -15.88

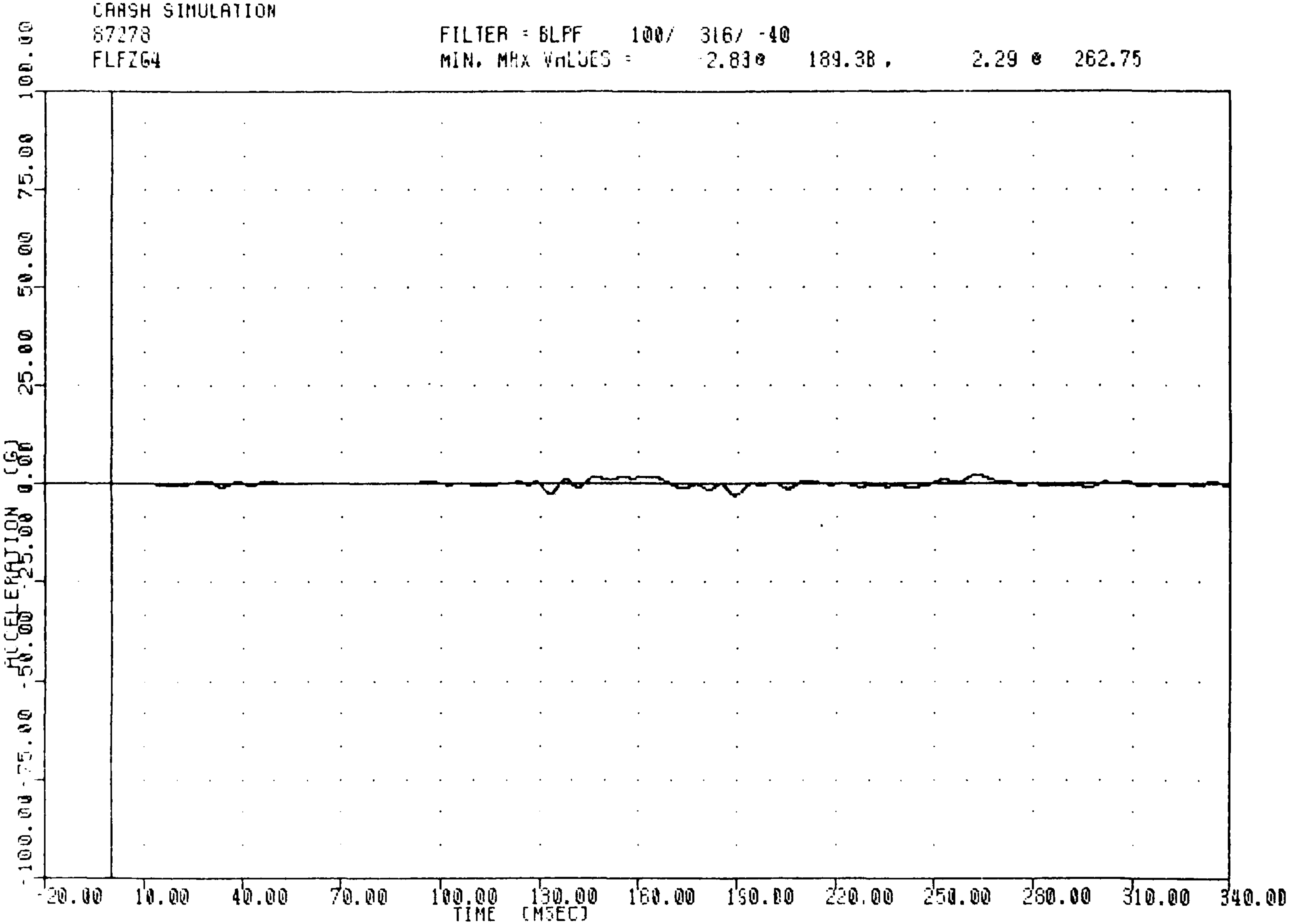


TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD SEAT TRACK LONGITUDINAL VELOCITY - FORWARD

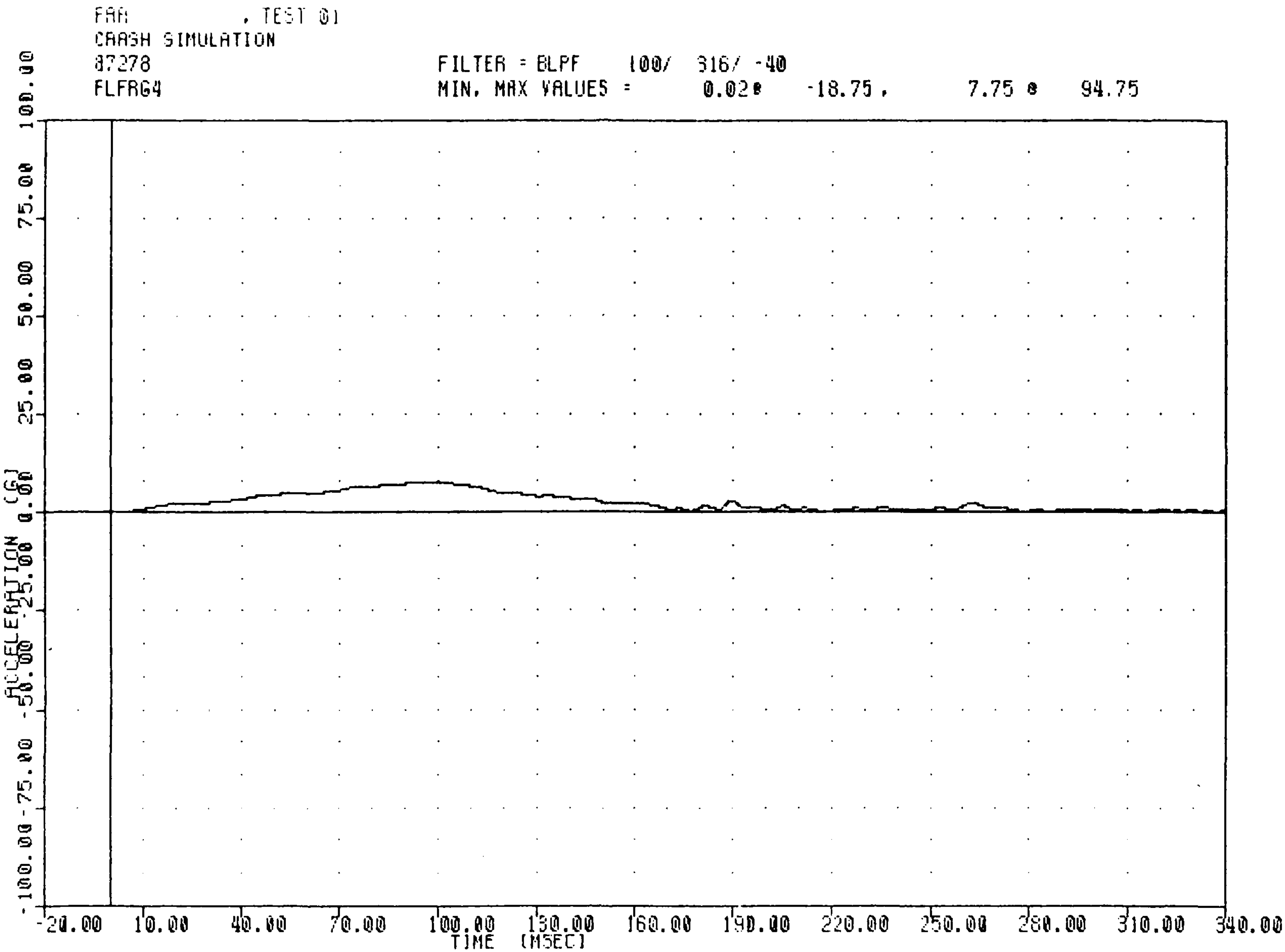

FAA , TEST 01
CRASH SIMULATION
97278
FLFYG4
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.28 @ 67.00 , 0.43 @ 180.25
100.00
75.00
50.00
25.00
0.00
-25.00
-50.00
-75.00
-100.00
ACCELERATION (G)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD SEAT TRACK LATERAL ACCELERATION - FORWARD

FAA , TEST 01
CRASH SIMULATION
87278
FLFZ64

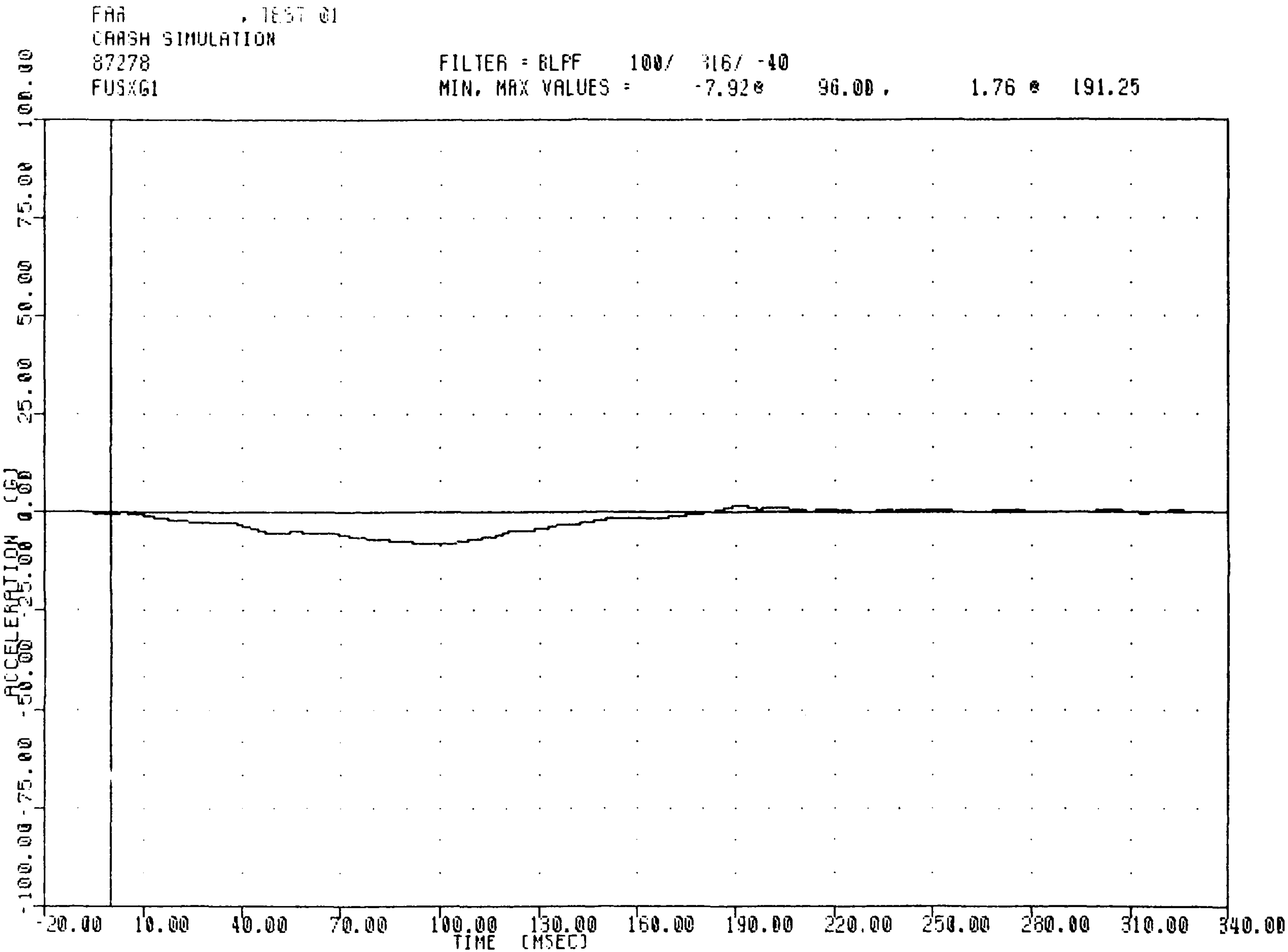
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -2.83 @ 189.38 , 2.29 @ 262.75



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD SEAT TRACK VERTICAL ACCELERATION - FORWARD



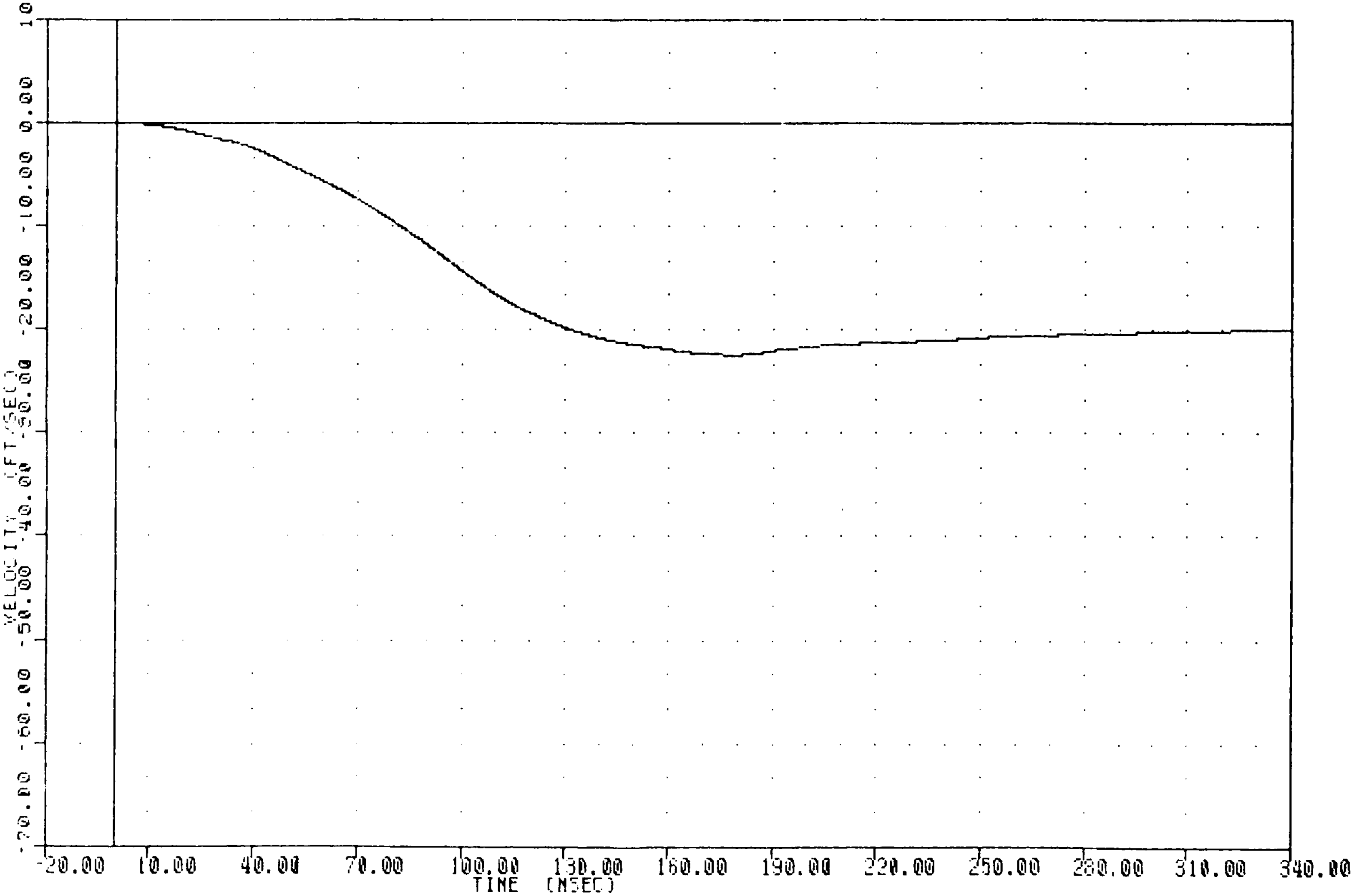
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD SEAT TRACK ACCELERATION - FORWARD RESULTANT



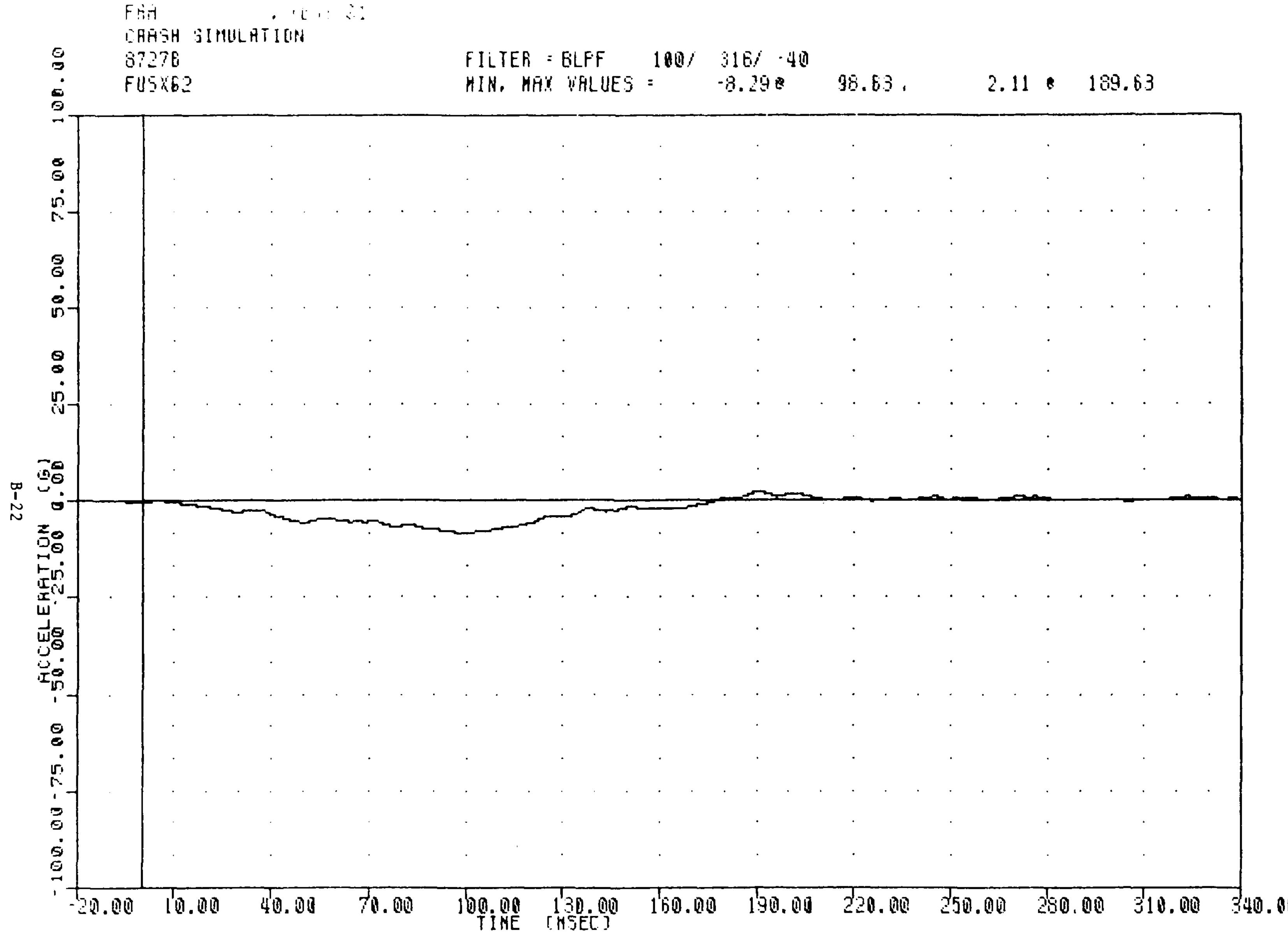
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
PORT FUSELAGE LONGITUDINAL ACCELERATION

FAA , TEST 01
CRASH SIMULATION
87278
FUSXV1

FILTER = BLPF 300/ 949/ -40
MIN. MAX VALUES = -22.44 @ 180.13 . 0.00 @ -11.75



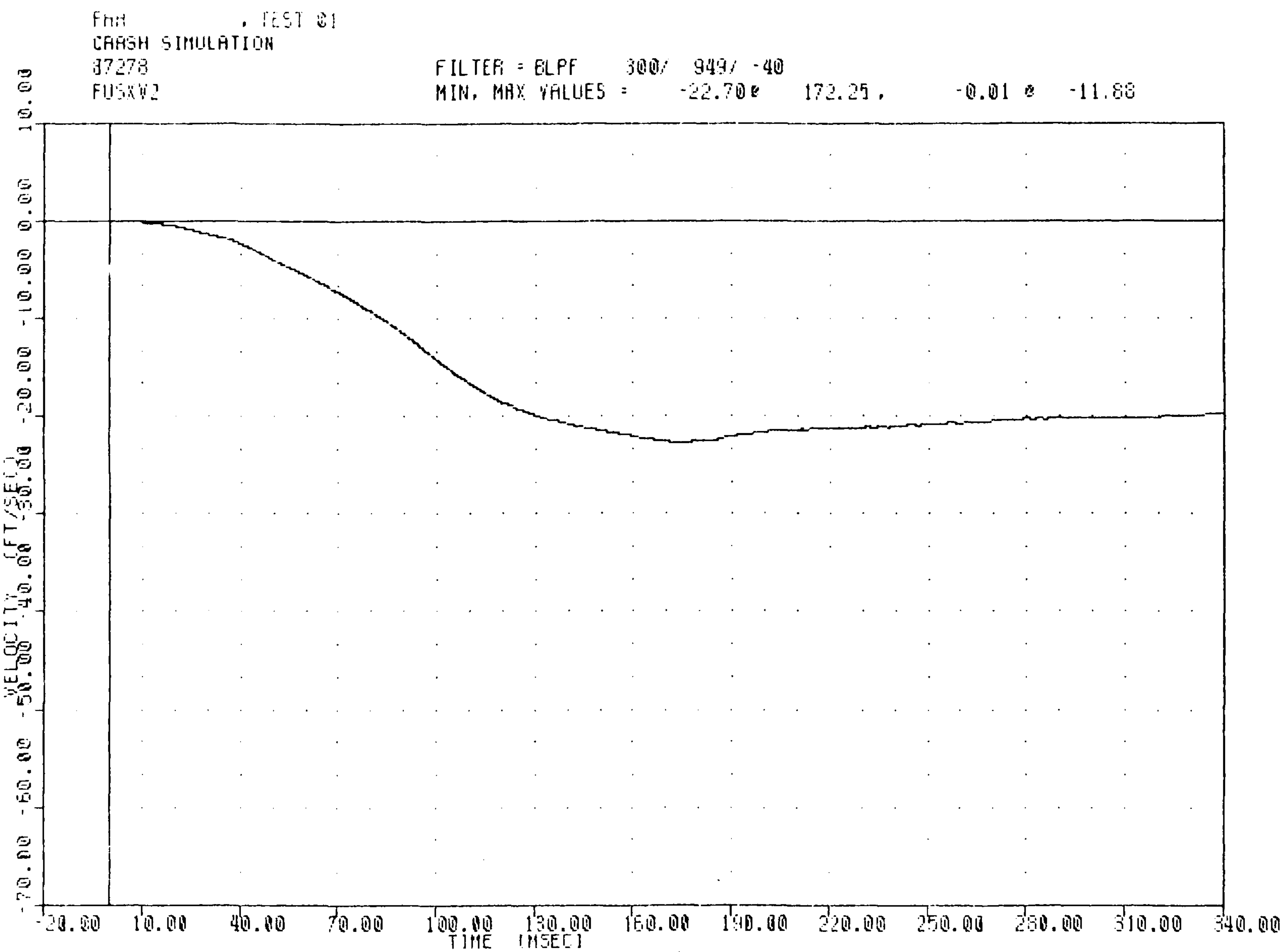
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
PORT FUSELAGE LONGITUDINAL VELOCITY



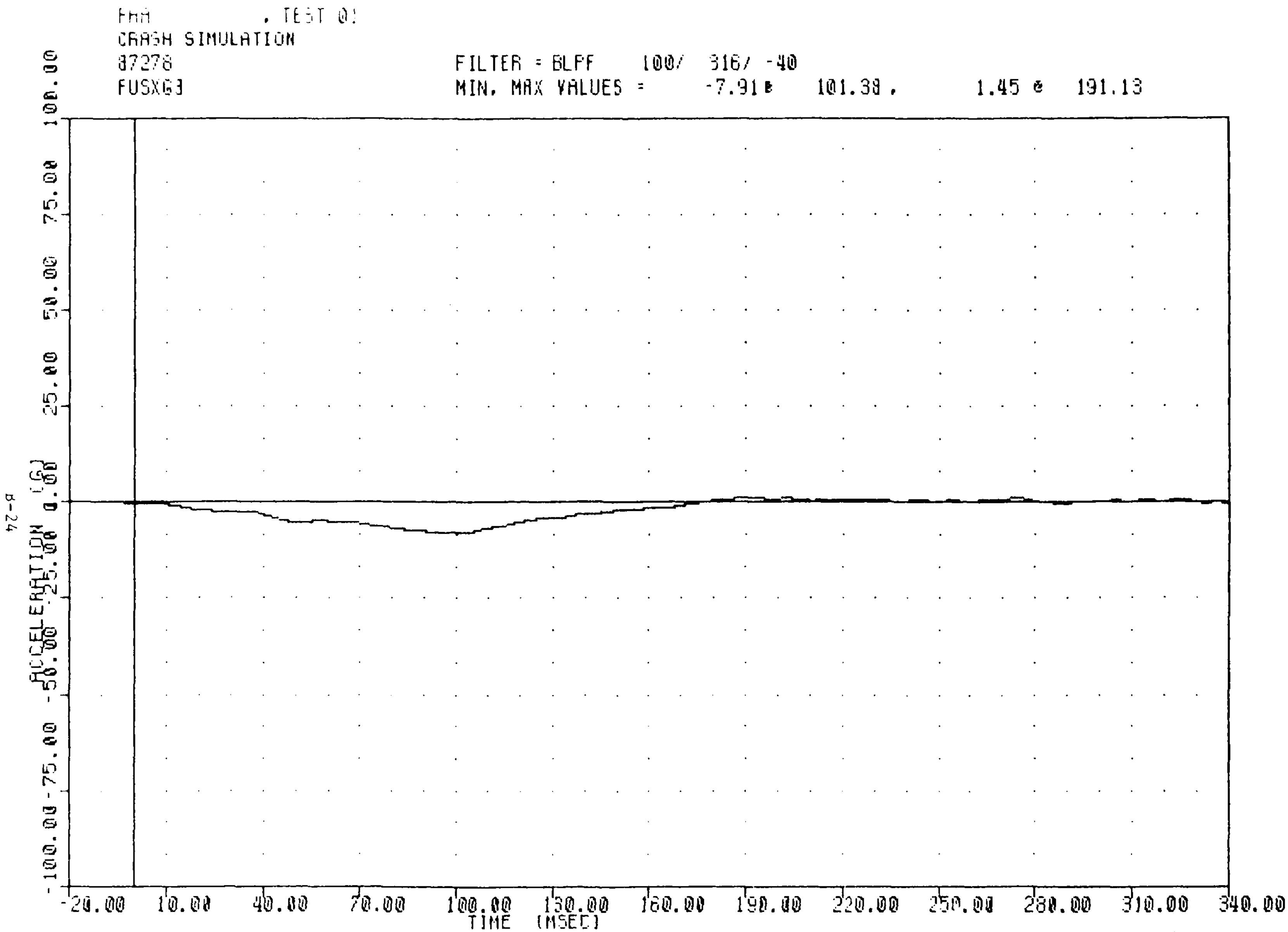
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
TOP FUSELAGE LONGITUDINAL ACCELERATION

APPENDIX A

INSTRUMENTATION LIST



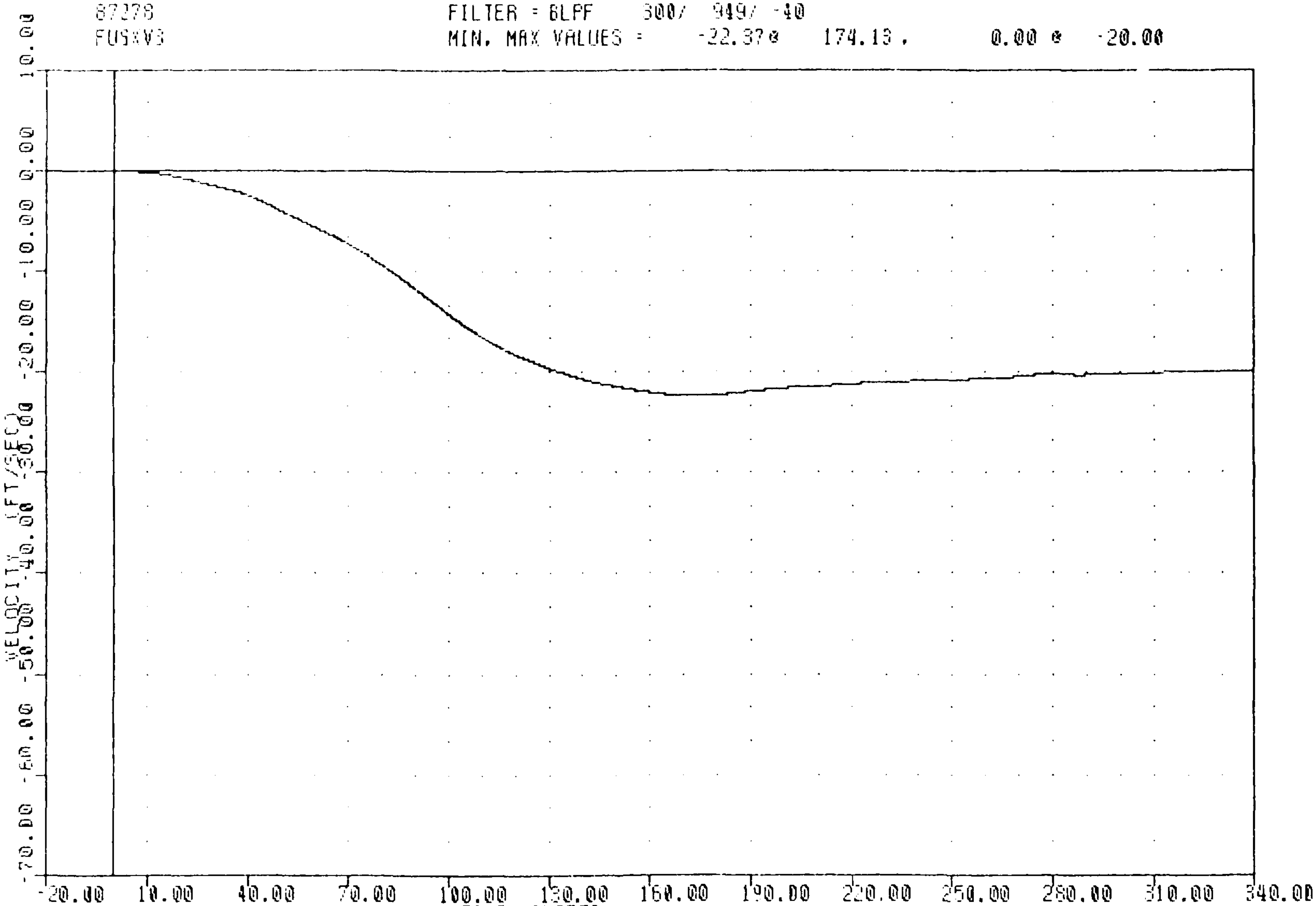
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
TOP FUSELAGE LONGITUDINAL VELOCITY



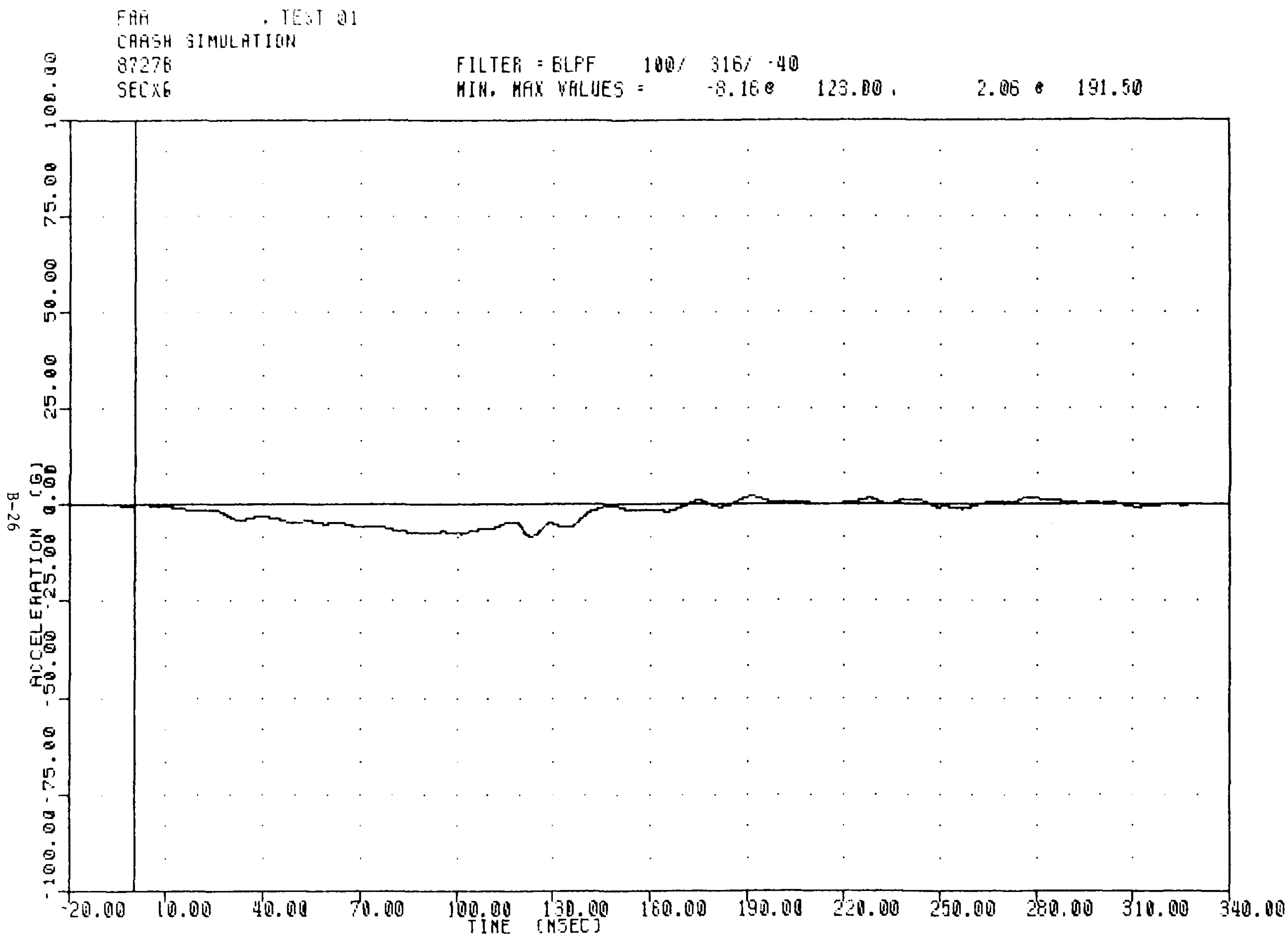
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD FUSELAGE LONGITUDINAL ACCELERATION

CAA . [illegible]
CRASH SIMULATION
87278
FUSXV3

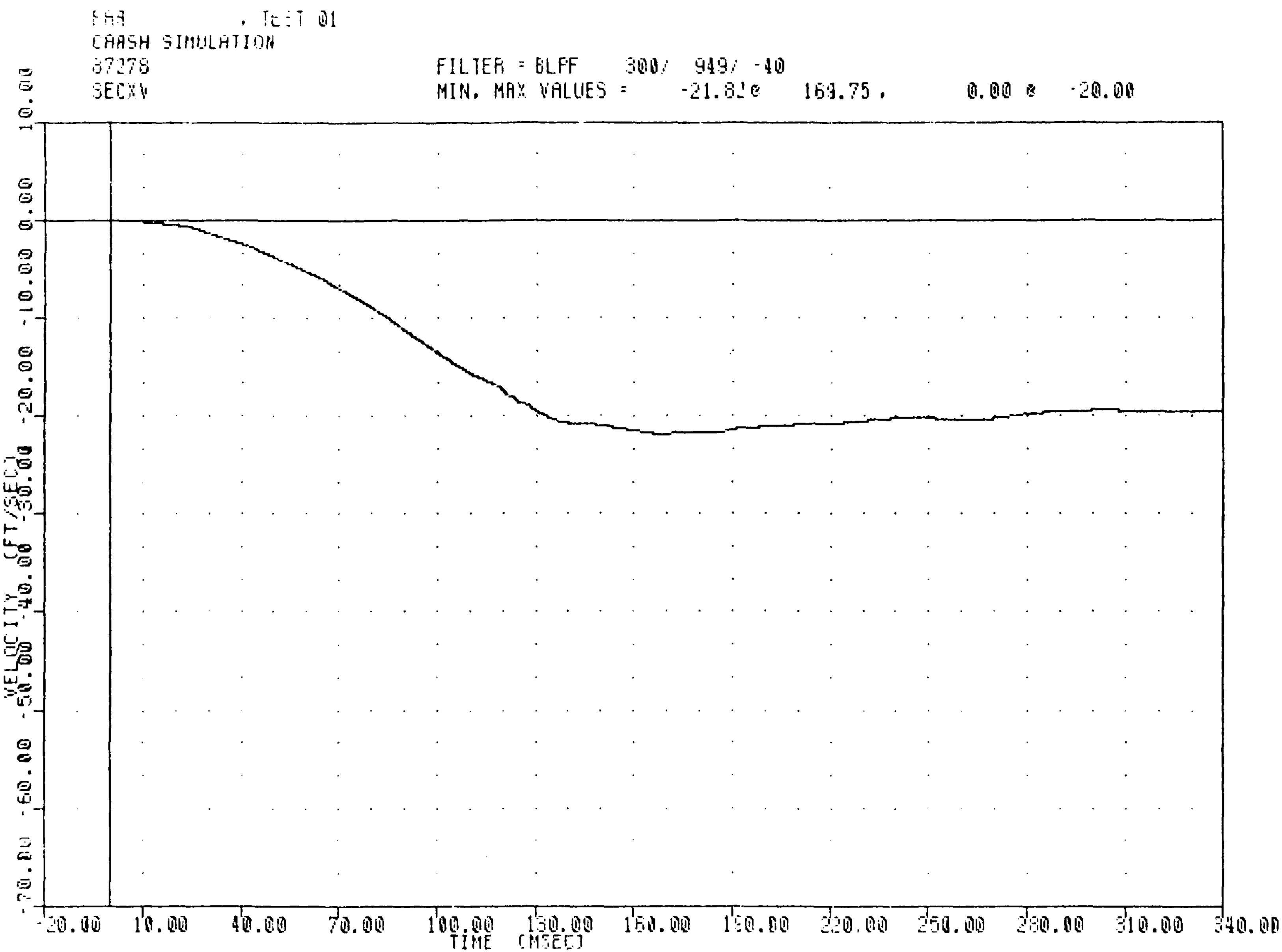
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -22.37@ 174.13, 0.00 @ -20.00



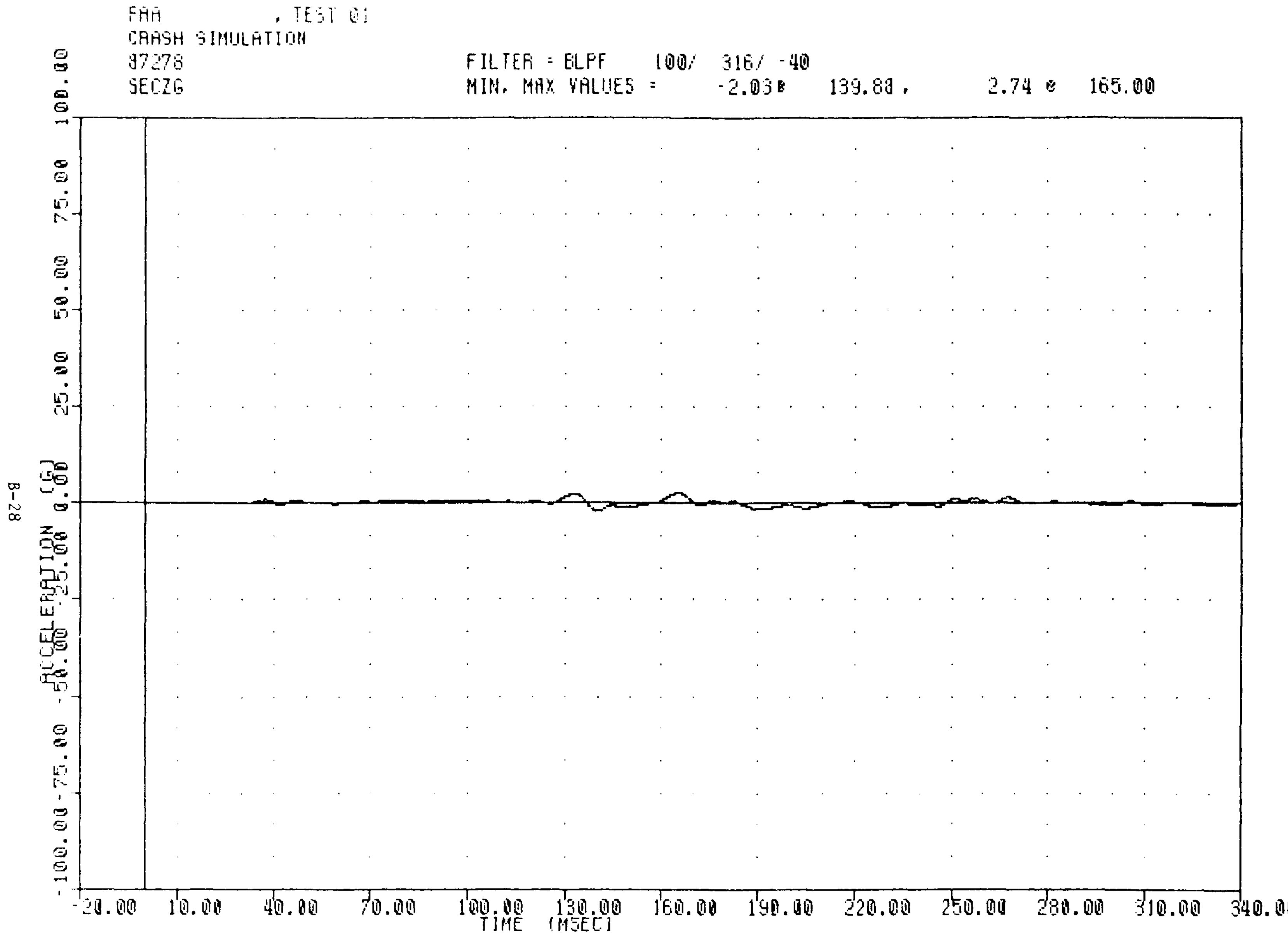
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD FUSELAGE LONGITUDINAL VELOCITY



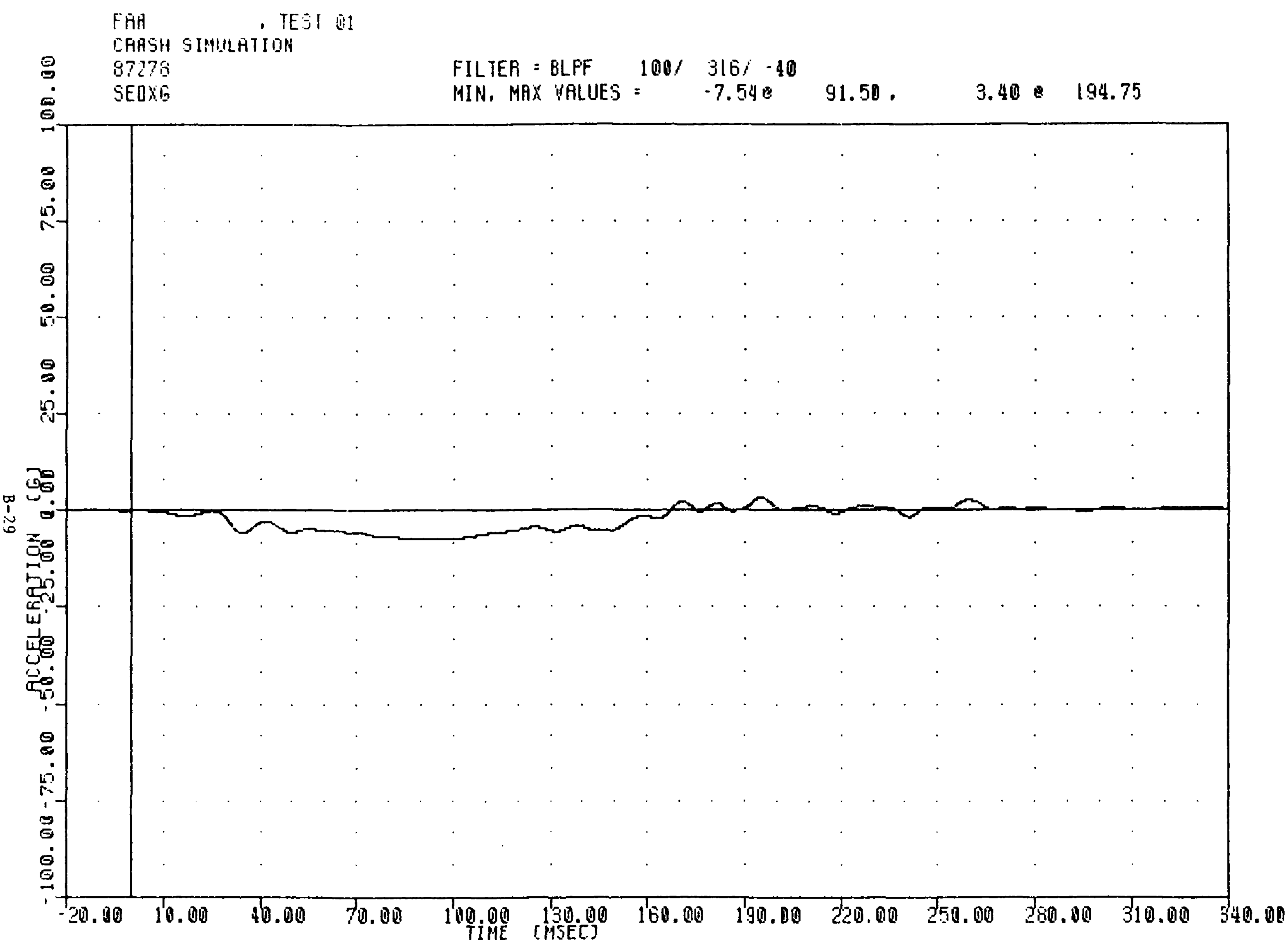
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT C LONGITUDINAL ACCELERATION



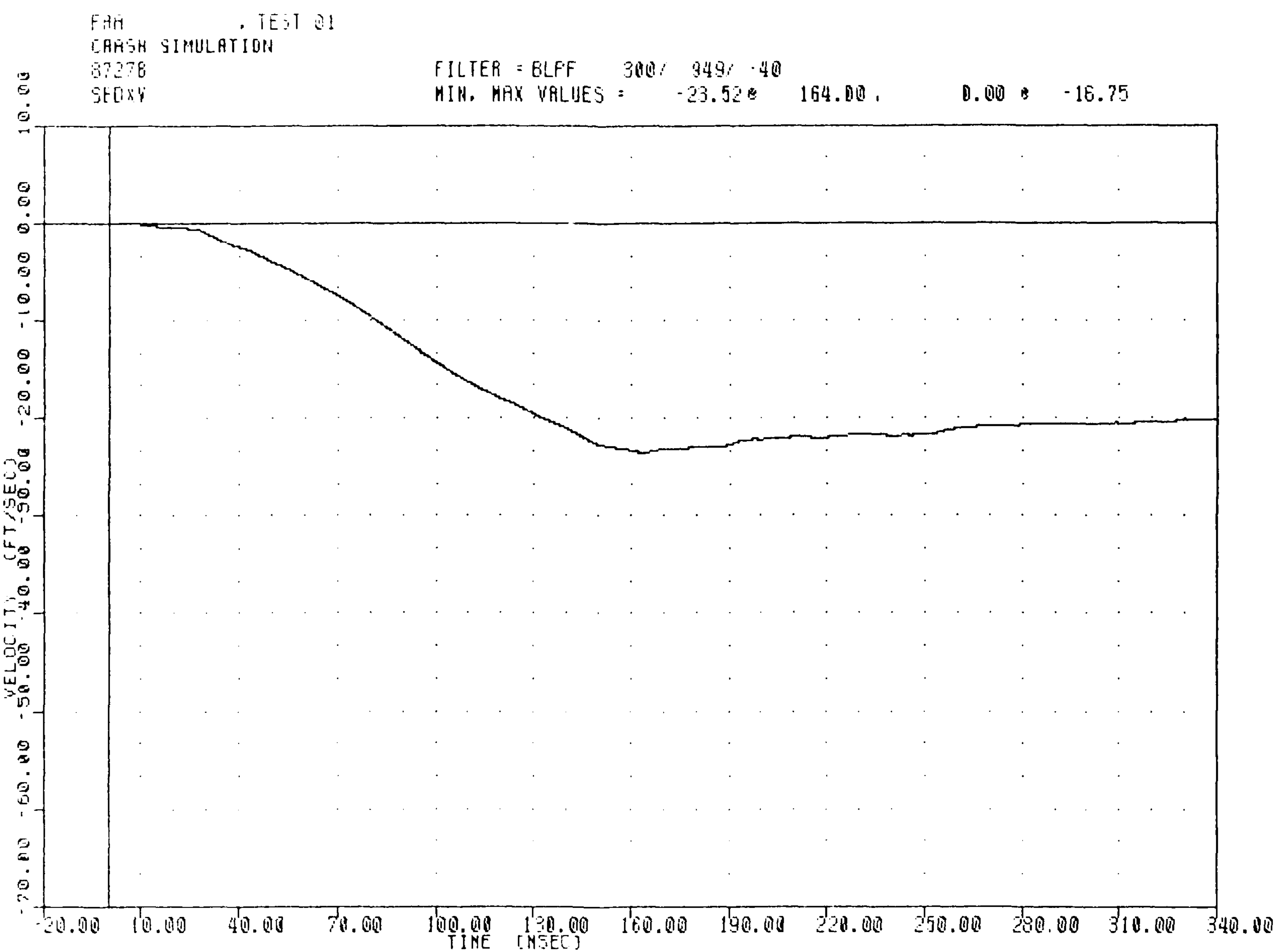
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT C LONGITUDINAL VELOCITY



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT C VERTICAL ACCELERATION



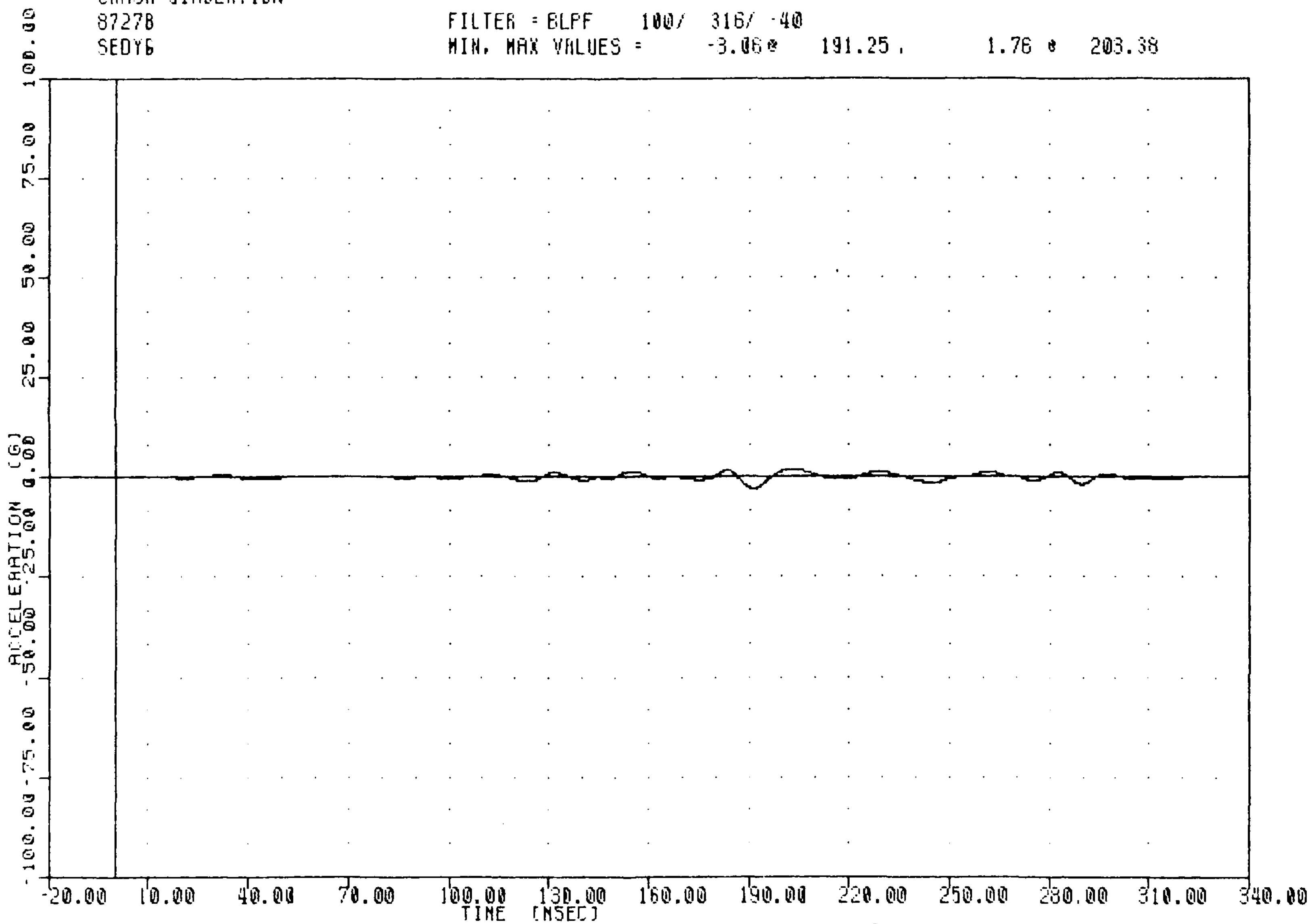
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT D LONGITUDINAL ACCELERATION



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT D LONGITUDINAL VELOCITY

FAA , TEST 01
CRASH SIMULATION
87278
SEDY6

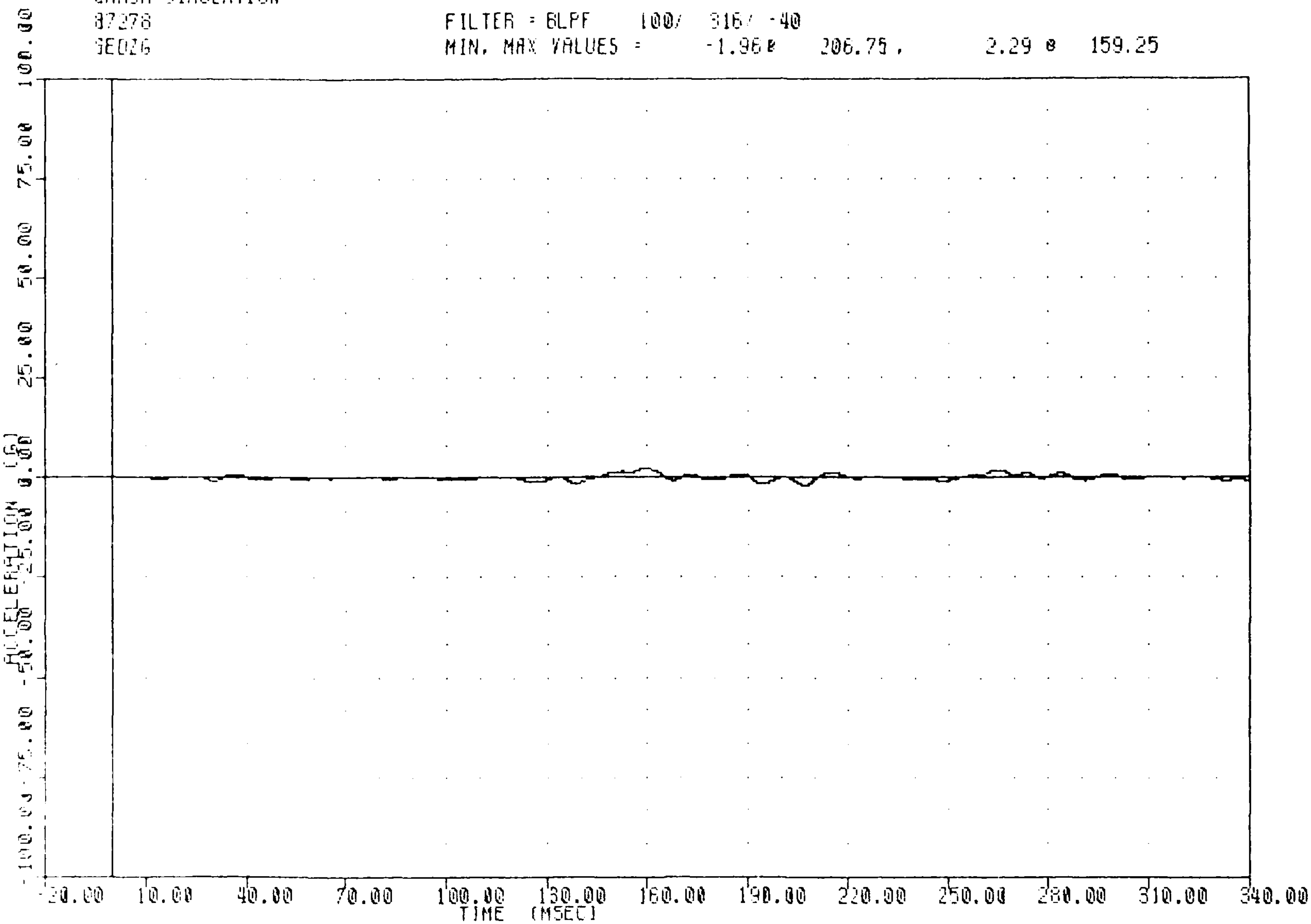
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -3.06 @ 191.25 , 1.76 @ 203.38



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT D LATERAL ACCELERATION

FAA , TEST 01
CRASH SIMULATION
87278
SEDZG

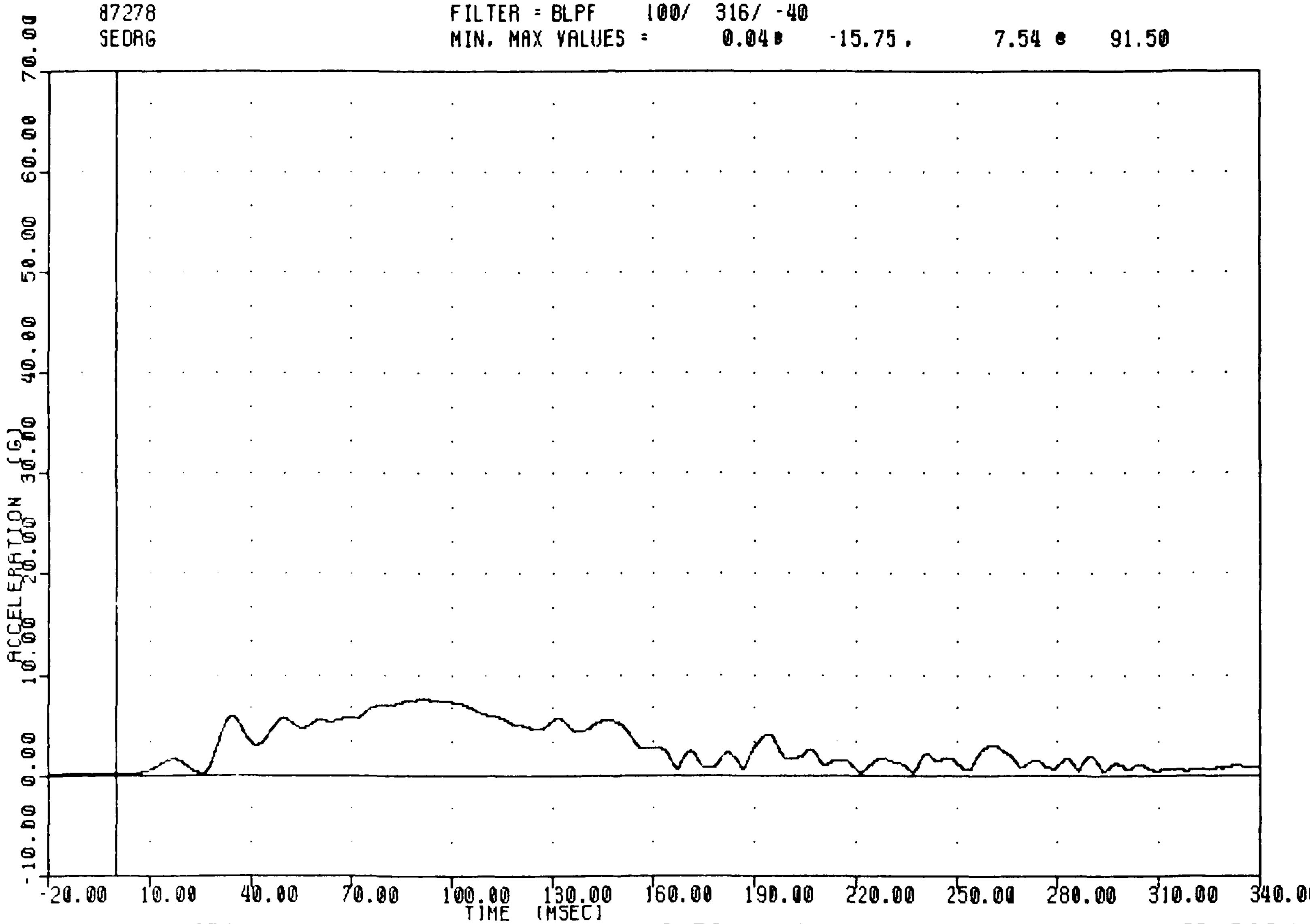
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -1.96 @ 206.75 , 2.29 @ 159.25



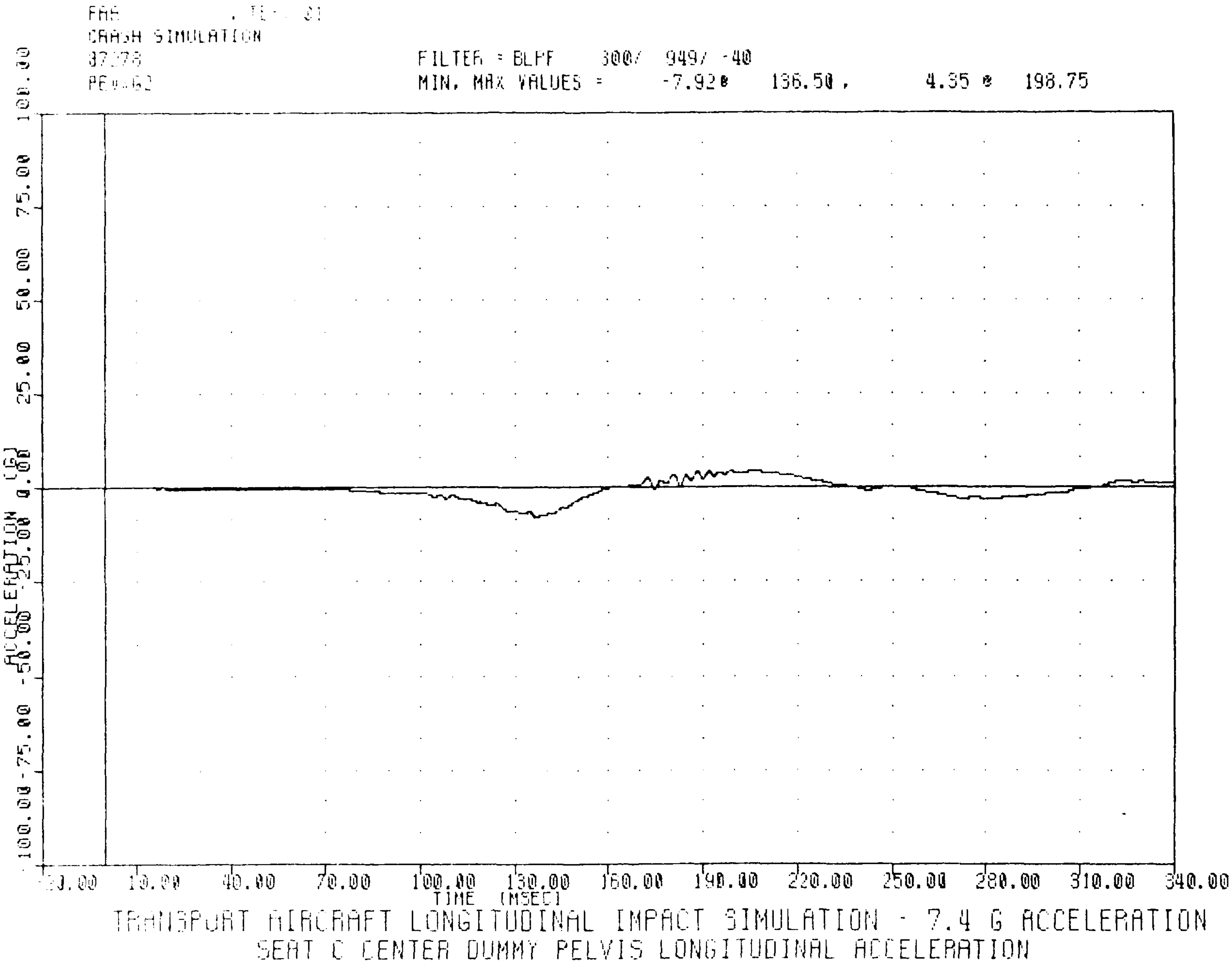
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT D VERTICAL ACCELERATION

FAA , TEST 01
CRASH SIMULATION
87278
SEDRG

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = 0.04 @ -15.75 , 7.54 @ 91.50

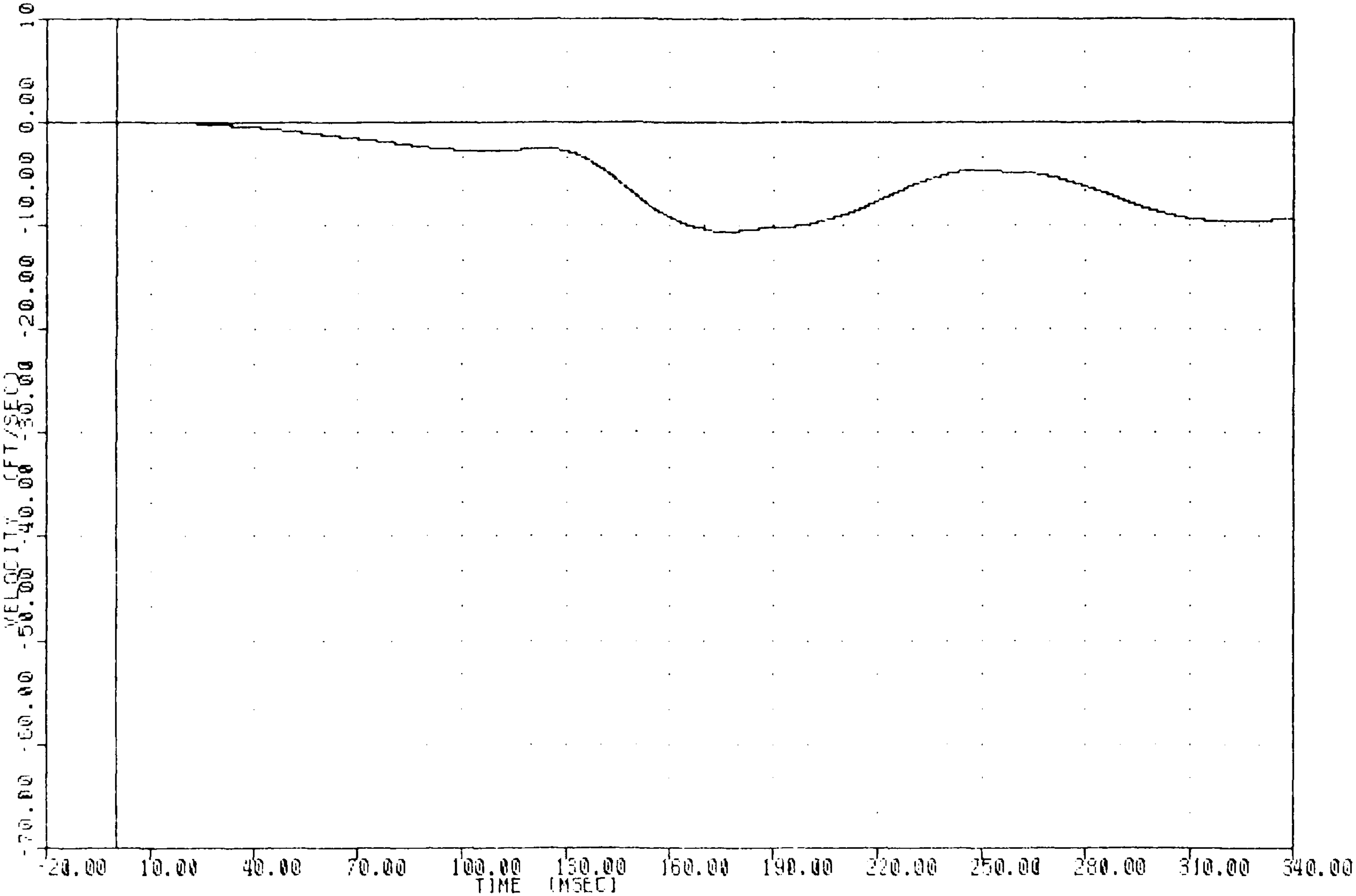


TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT D ACCELERATION RESULTANT


FAA
CRASH SIMULATION
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -7.92 @ 136.50 , 4.35 @ 198.75
100.00
75.00
50.00
25.00
0.00
-25.00
-50.00
-75.00
-100.00
ACCELERATION (G)
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT C CENTER DUMMY PELVIS LONGITUDINAL ACCELERATION

FAA , TEST 01
CRASH SIMULATION
87278
PEVXV1

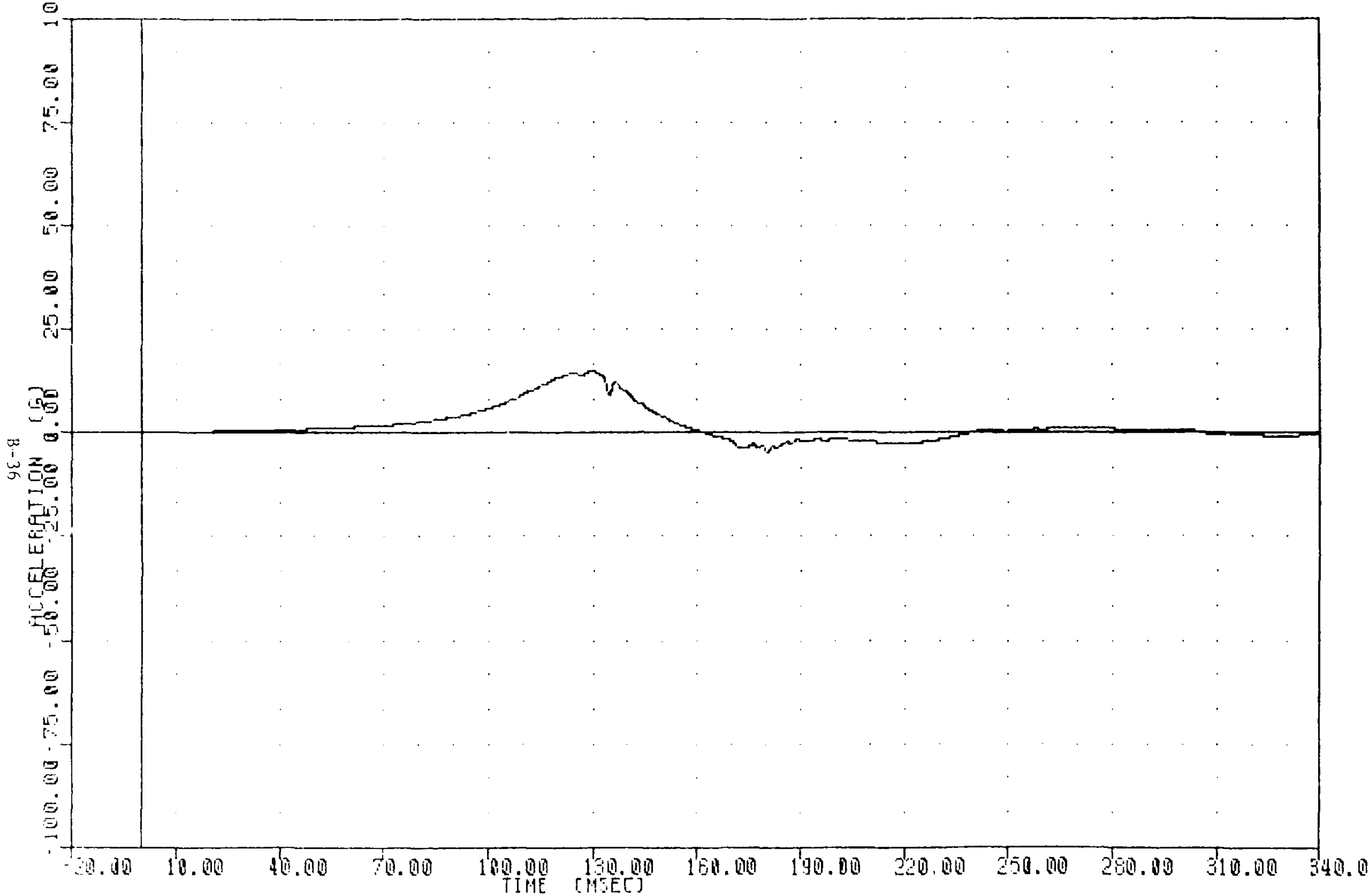
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -10.69 @ 174.50 , 0.00 @ -12.38



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT D CENTER DUMMY PELVIS LONGITUDINAL VELOCITY

FAA , TEST 01
CRASH SIMULATION
87278
PEVZG2

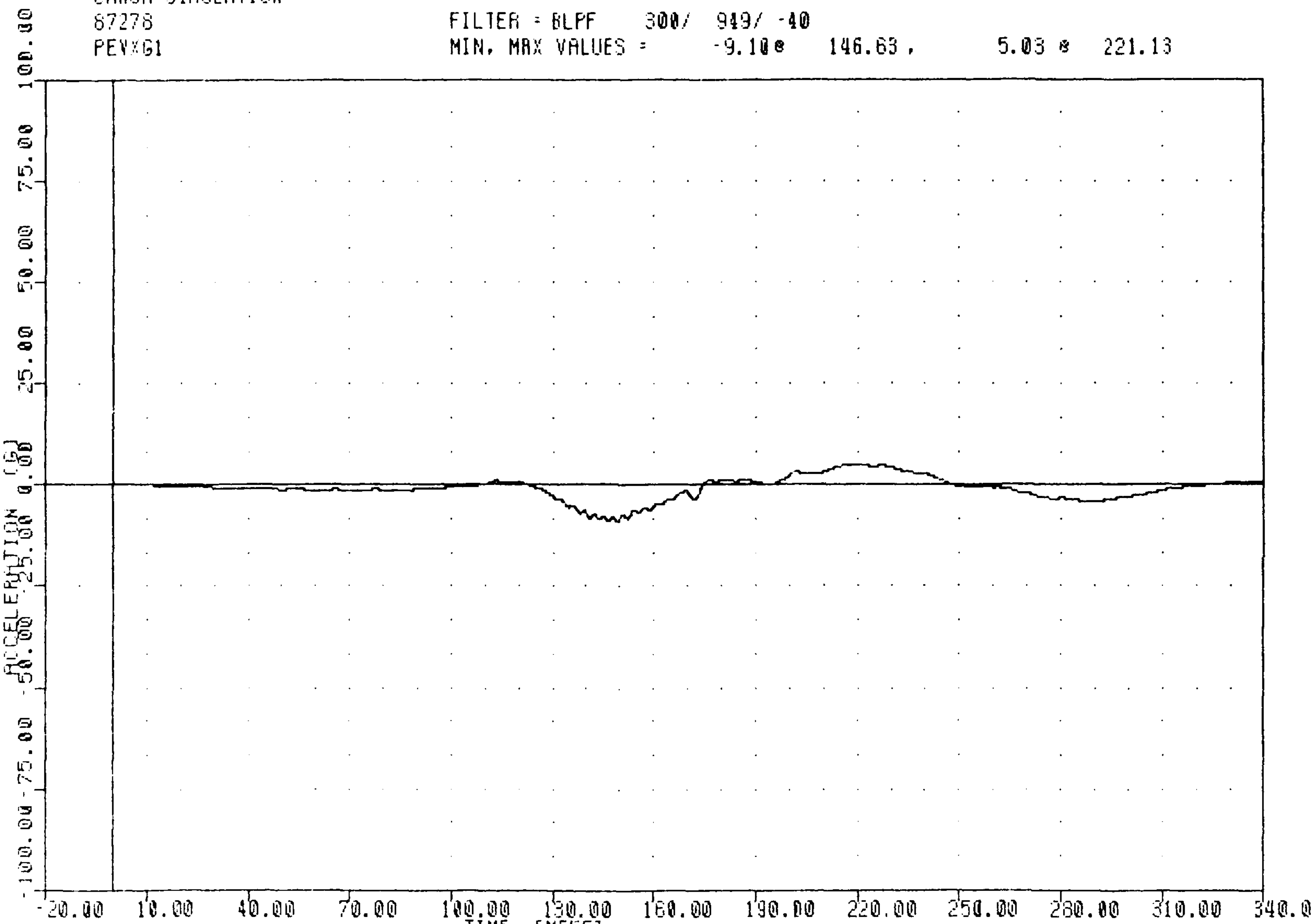
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -4.78 @ 180.13 , 14.88 @ 129.75



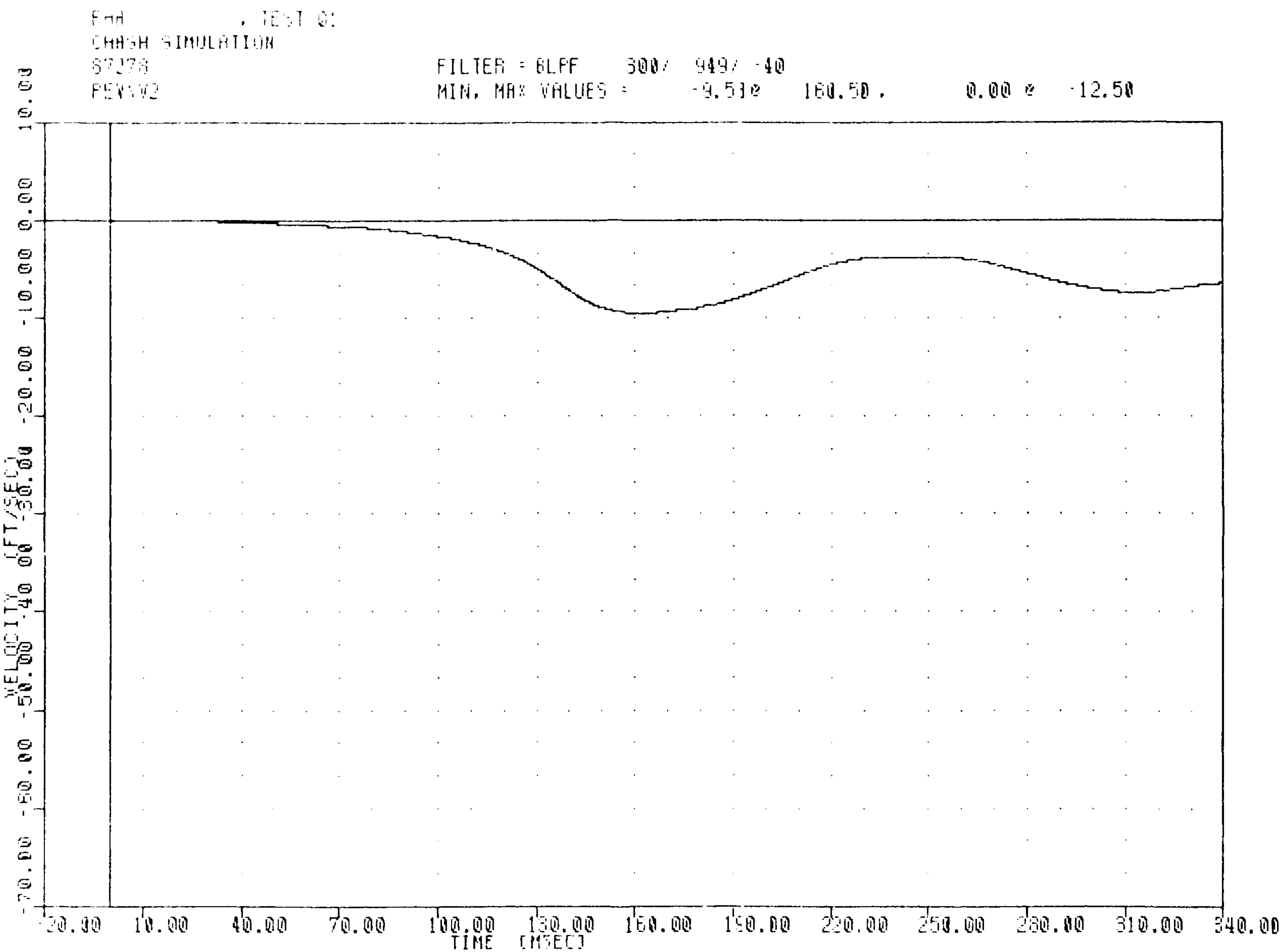
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT C CENTER DUMMY PELVIS VERTICAL ACCELERATION

FAA , TEST 01
CRASH SIMULATION
87278
PEVXG1

FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -9.10 @ 146.63 , 5.03 @ 221.13

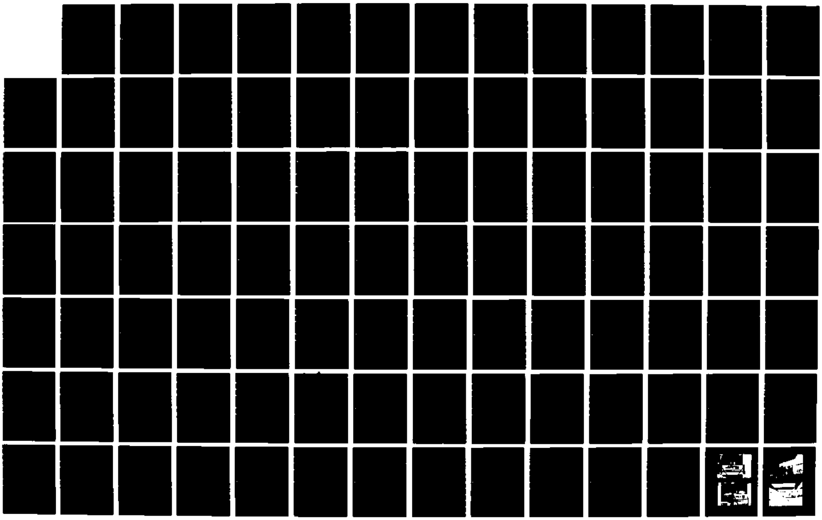


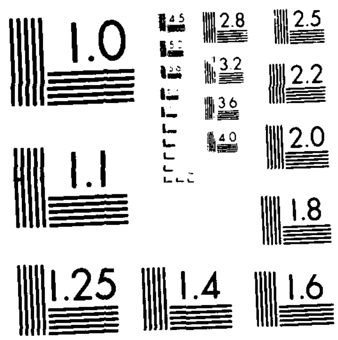
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT D CENTER DUMMY PELVIS LONGITUDINAL ACCELERATION

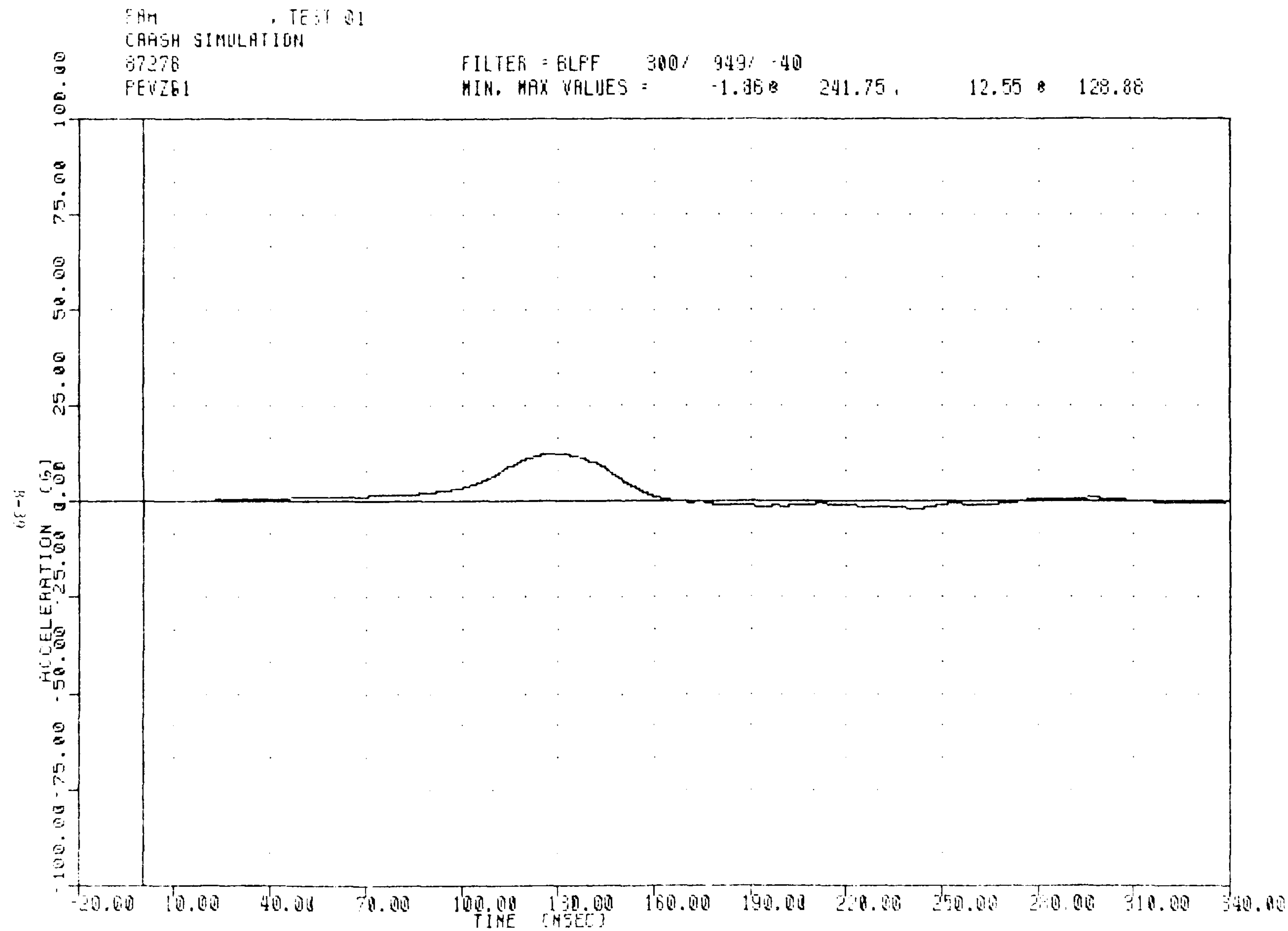


TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT C CENTER DUMMY PELVIS LONGITUDINAL VELOCITY

AD-A195 309 LONGITUDINAL IMPACT TEST OF A TRANSPORT AIRFRAME 2/4
SECTION(U) FEDERAL AVIATION ADMINISTRATION TECHNICAL
CENTER ATLANTIC CIT.. R JOHNSON ET AL. JUL 88
UNCLASSIFIED DOT/FAA/CT-87/26 DTFA03-87-C-00013 F/G 1/3 NL



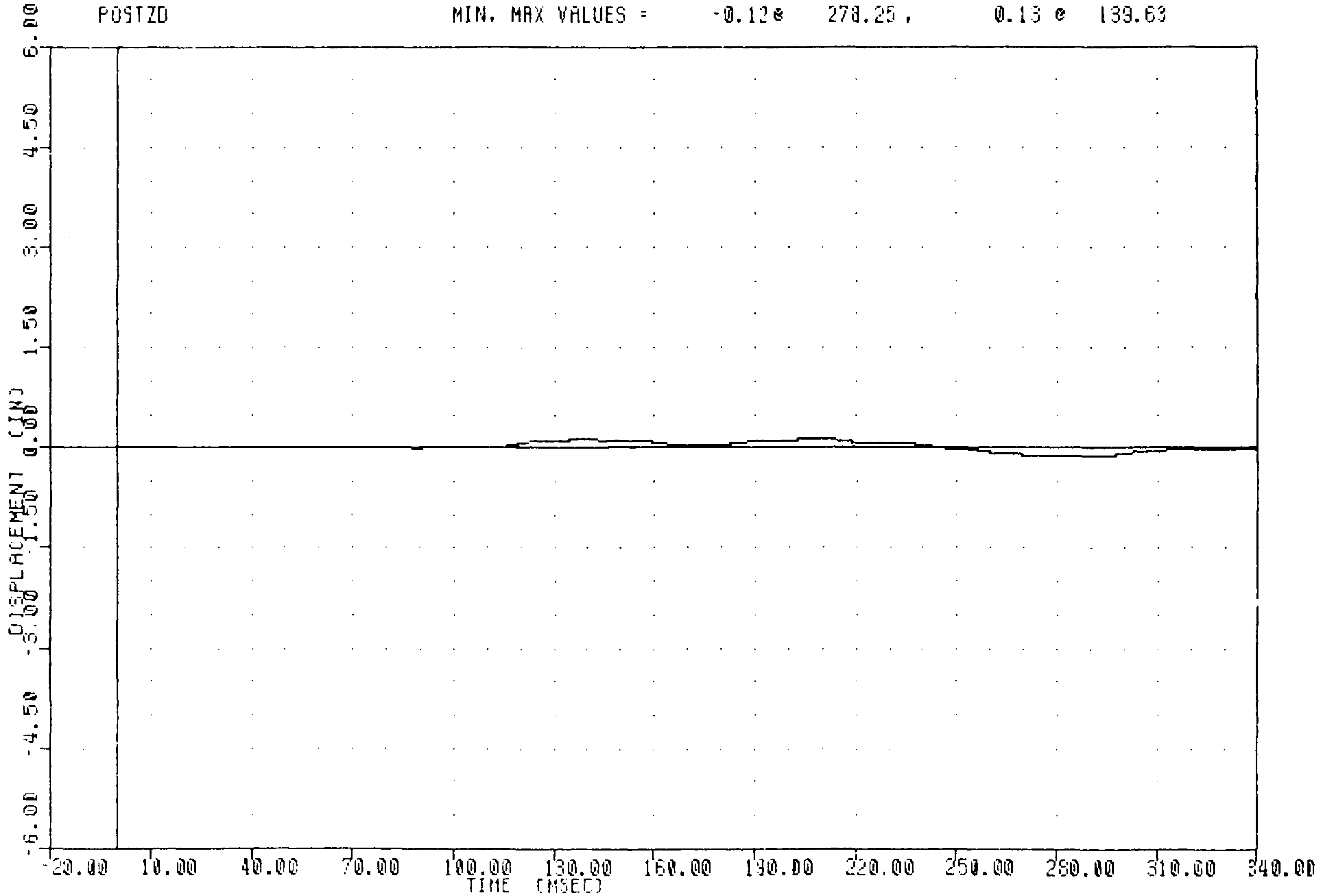

1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION 7.4 G ACCELERATION
SEAT D CENTER DUMMY PELVIS VERTICAL ACCELERATION

FAA , TEST 01
CRASH SIMULATION
87278
POSTZD

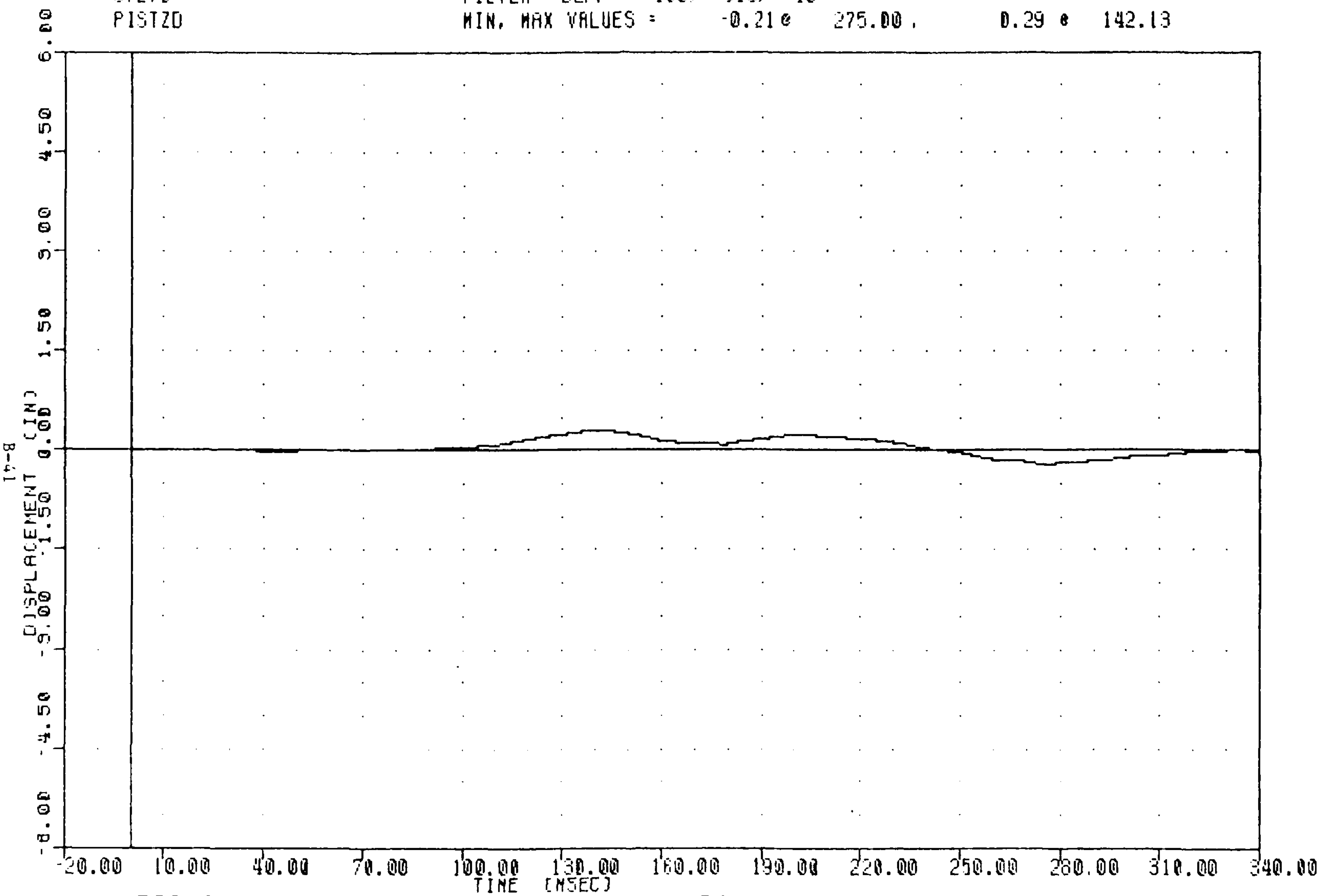
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.12 @ 278.25 , 0.13 @ 139.63



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
PORT OUTBOARD SEAT TRACK DEFLECTION

FAA , TEST 01
CRASH SIMULATION
67276
PISTZD

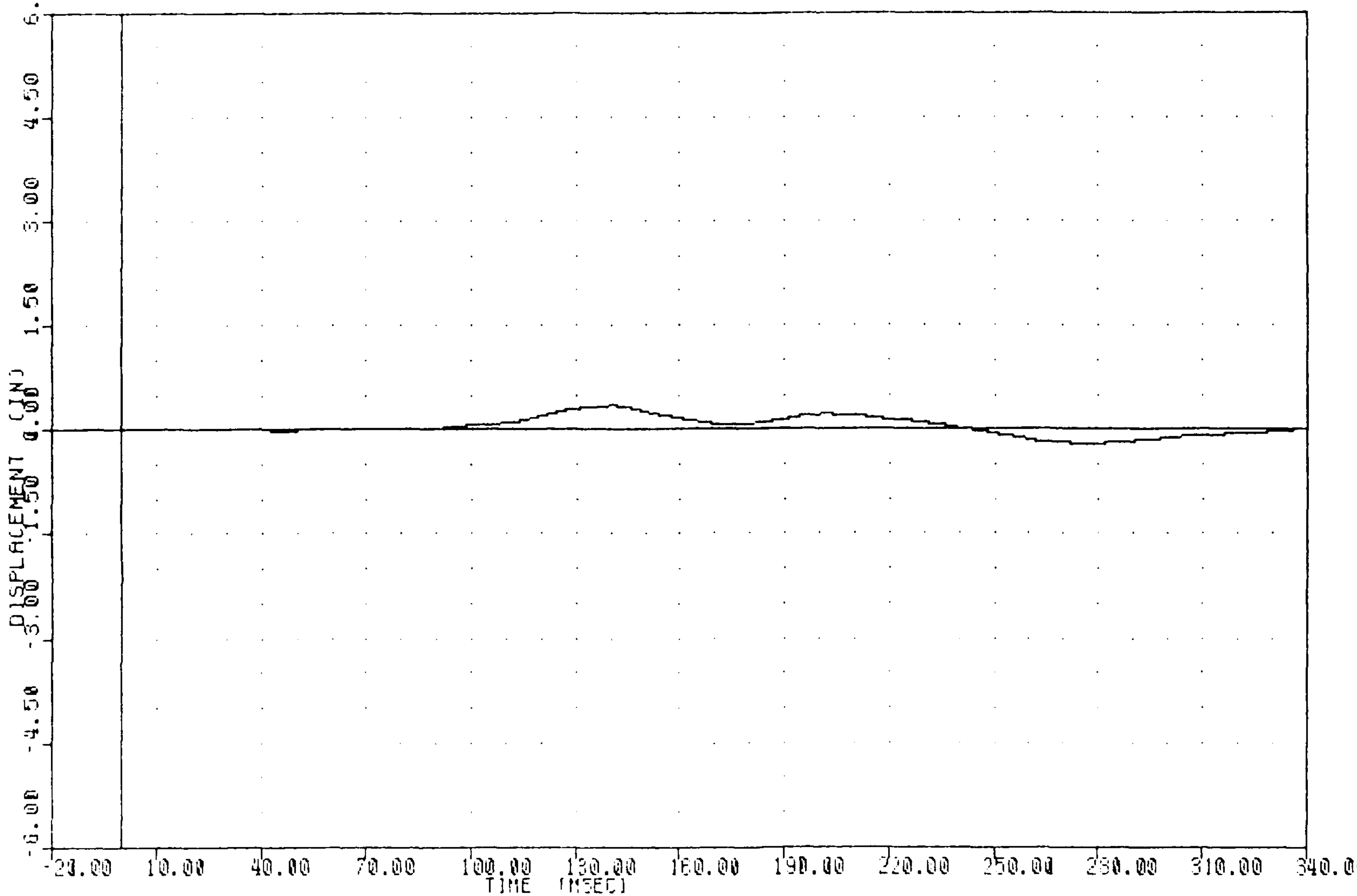
FILTER = BLPF 100/ 316/ 40
MIN, MAX VALUES = -0.21 @ 275.00 , 0.29 @ 142.13



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
PORT INBOARD SEAT TRACK DEFLECTION

FAA . TEST 31
CRASH SIMULATION
87278
SISTZO

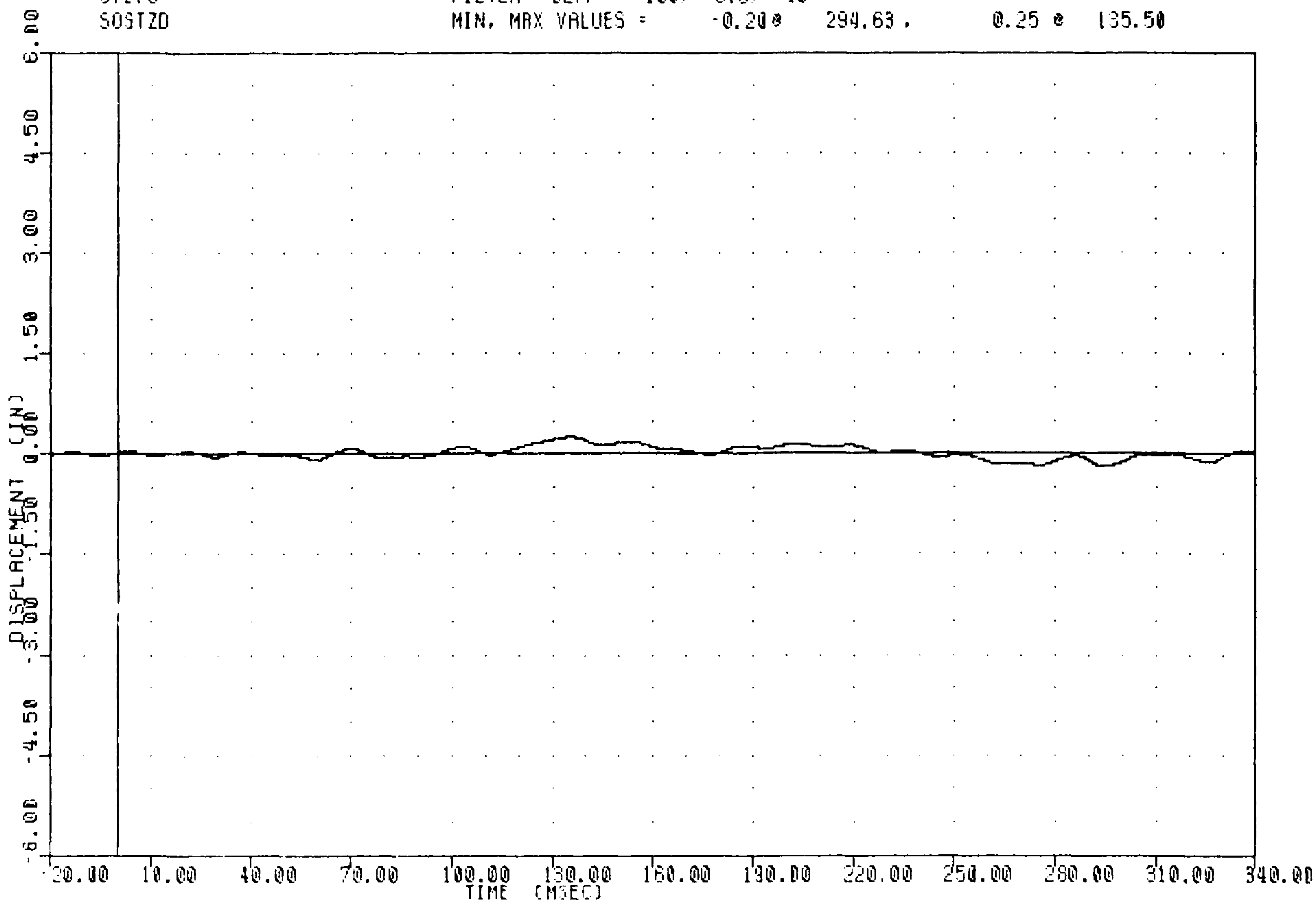
FILTER = BLFF 100/ 316/ -40
MIN, MAX VALUES = -0.21 @ 278.00 , 0.34 @ 140.63



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD SEAT TRACK DEFLECTION

FAA , TEST 01
CRASH SIMULATION
87278
SOSTZD

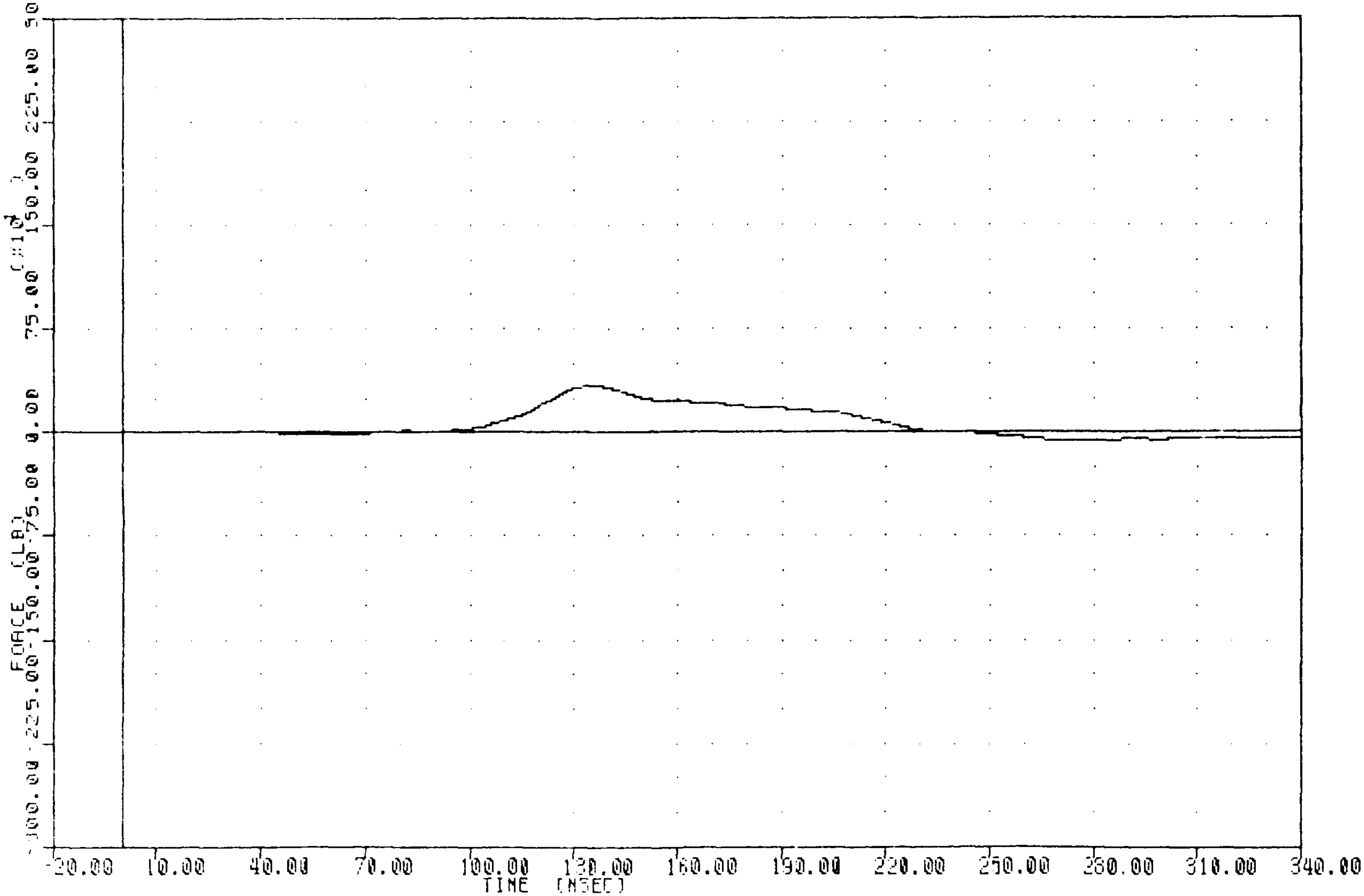
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.20 @ 294.63 , 0.25 @ 135.50



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD OUTBOARD SEAT TRACK DEFLECTION

FAA . TEST 31
CRASH SIMULATION
87278
LBOF2

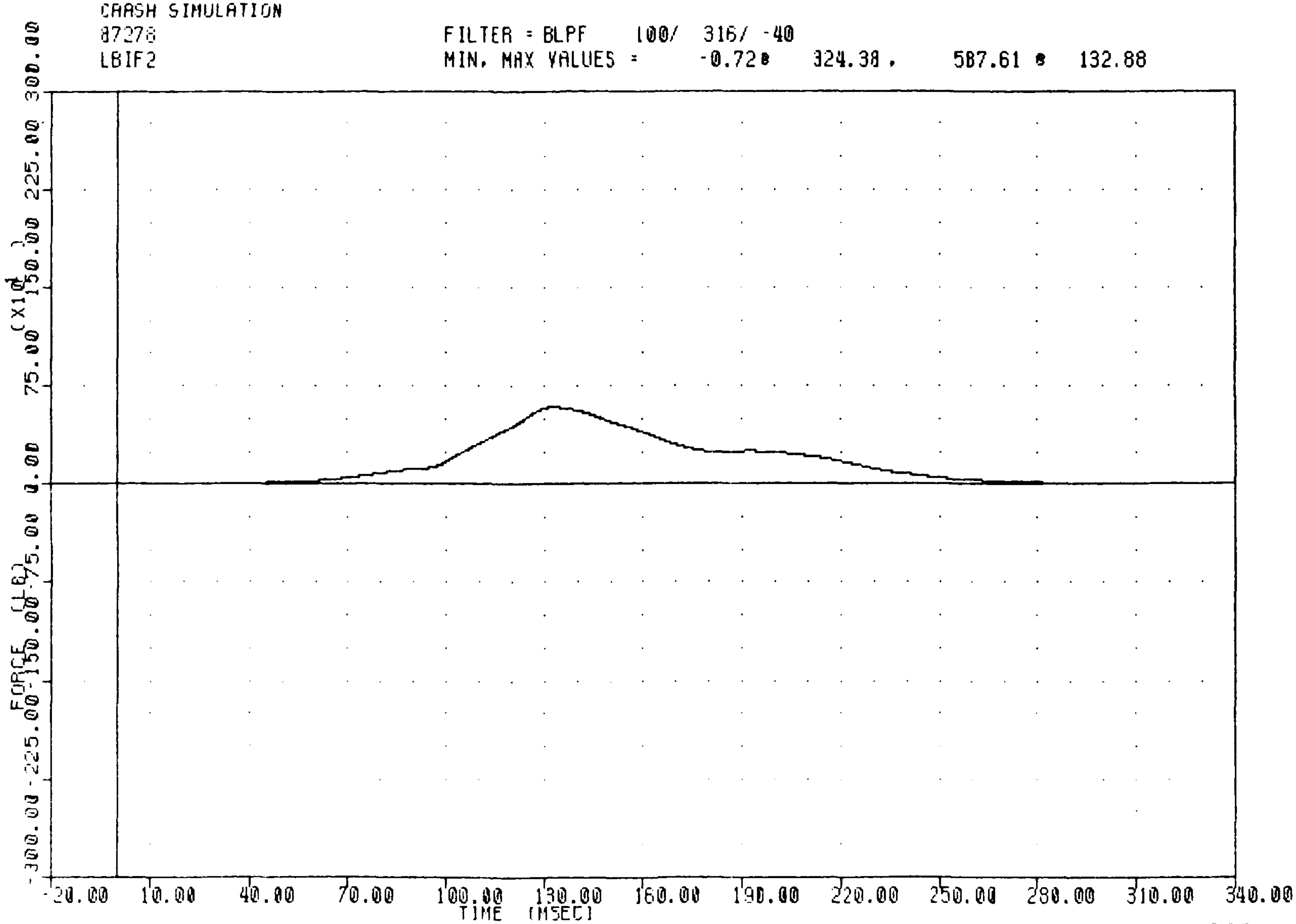
FILTER = BLPF 100/ 316/ 40
MIN, MAX VALUES = -63.12 @ 279.25 , 334.98 @ 135.75



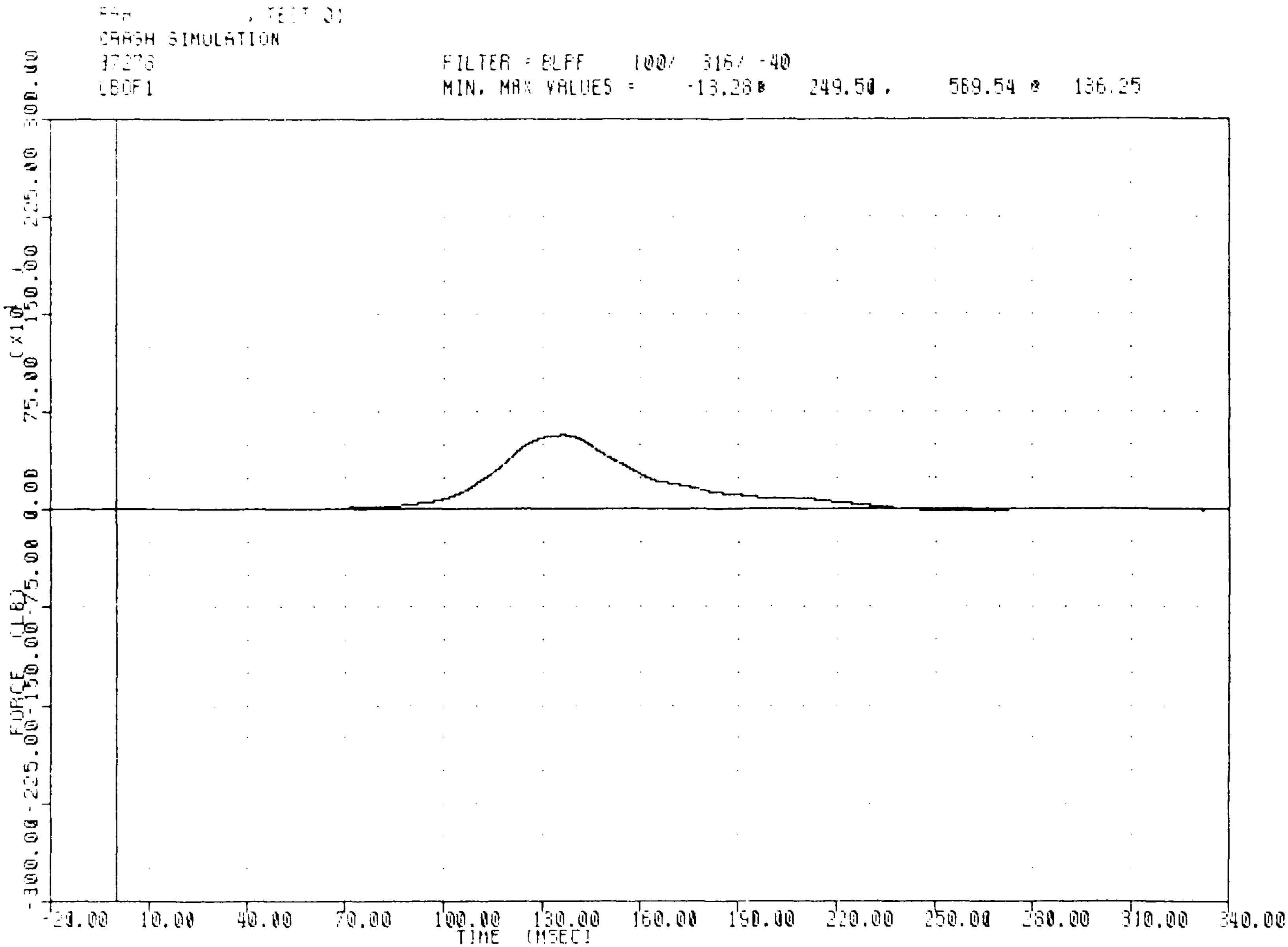
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT C CENTER DUMMY OUTBOARD LAP BELT LOAD

FAA , TEST 01
CRASH SIMULATION
87278
LBIF2

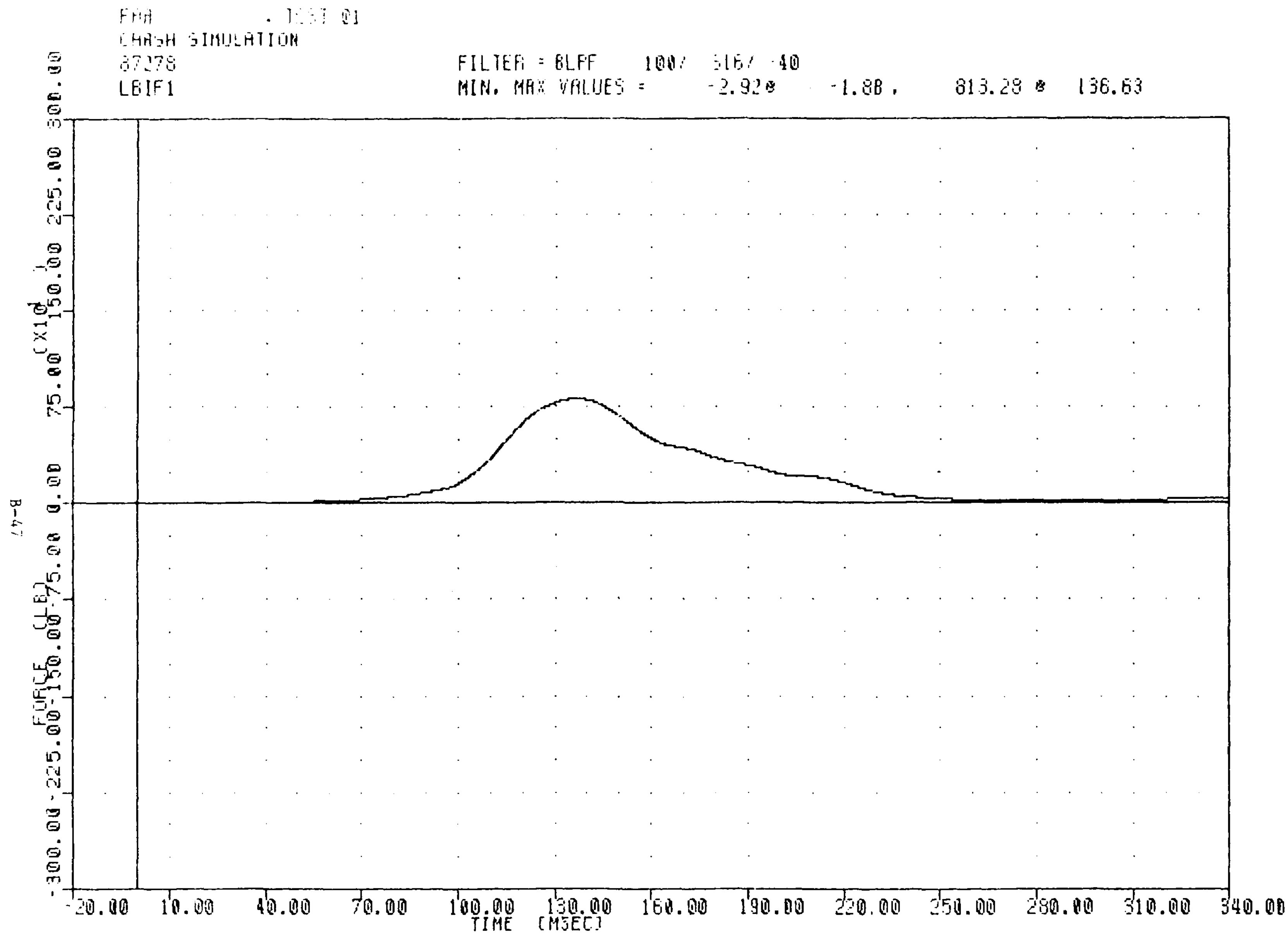
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.72 @ 324.38 , 587.61 @ 132.88



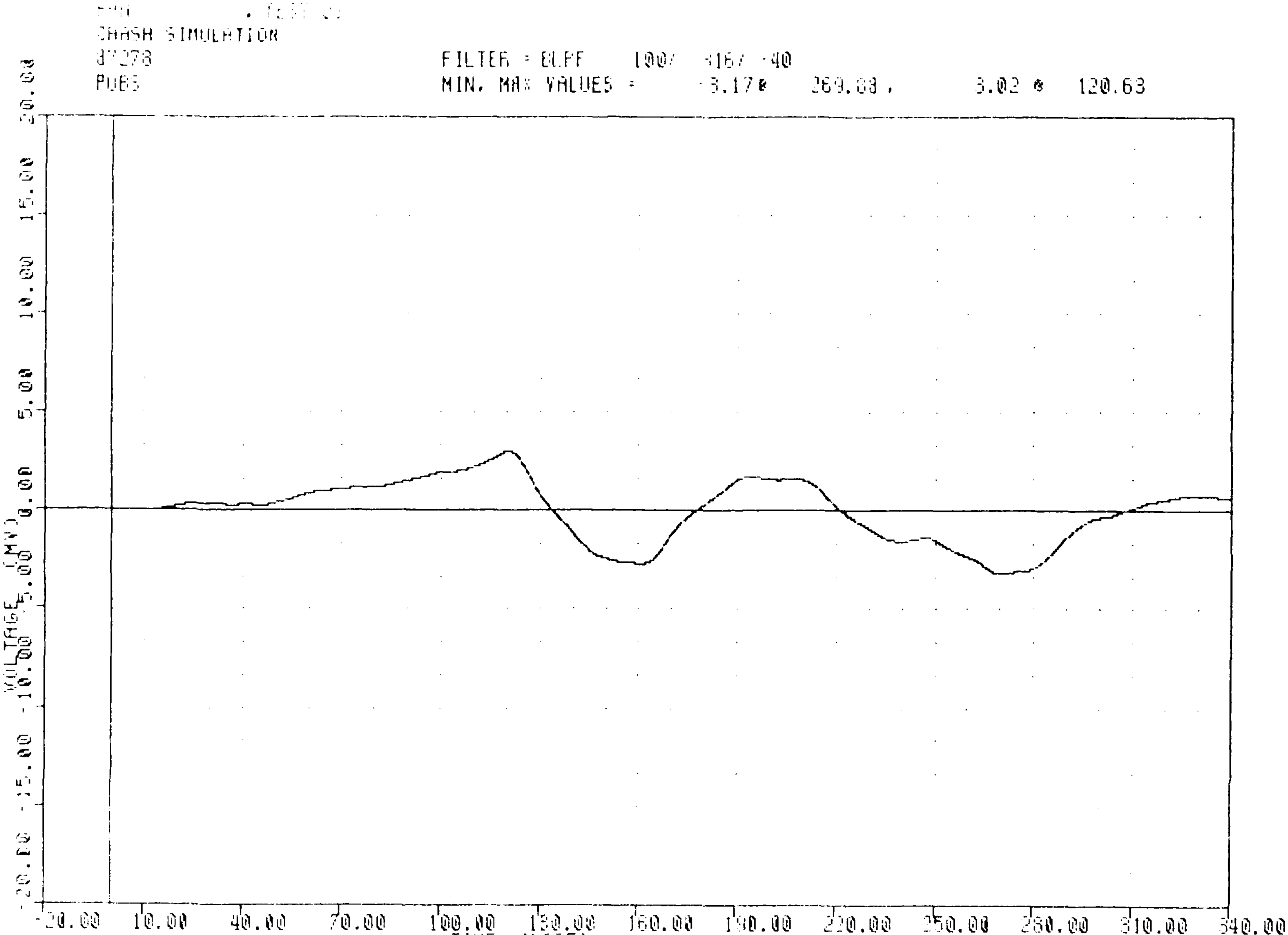
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT C CENTER DUMMY INBOARD LAP BELT LOAD



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT D CENTER DUMMY OUTBOARD LAP BELT LOAD



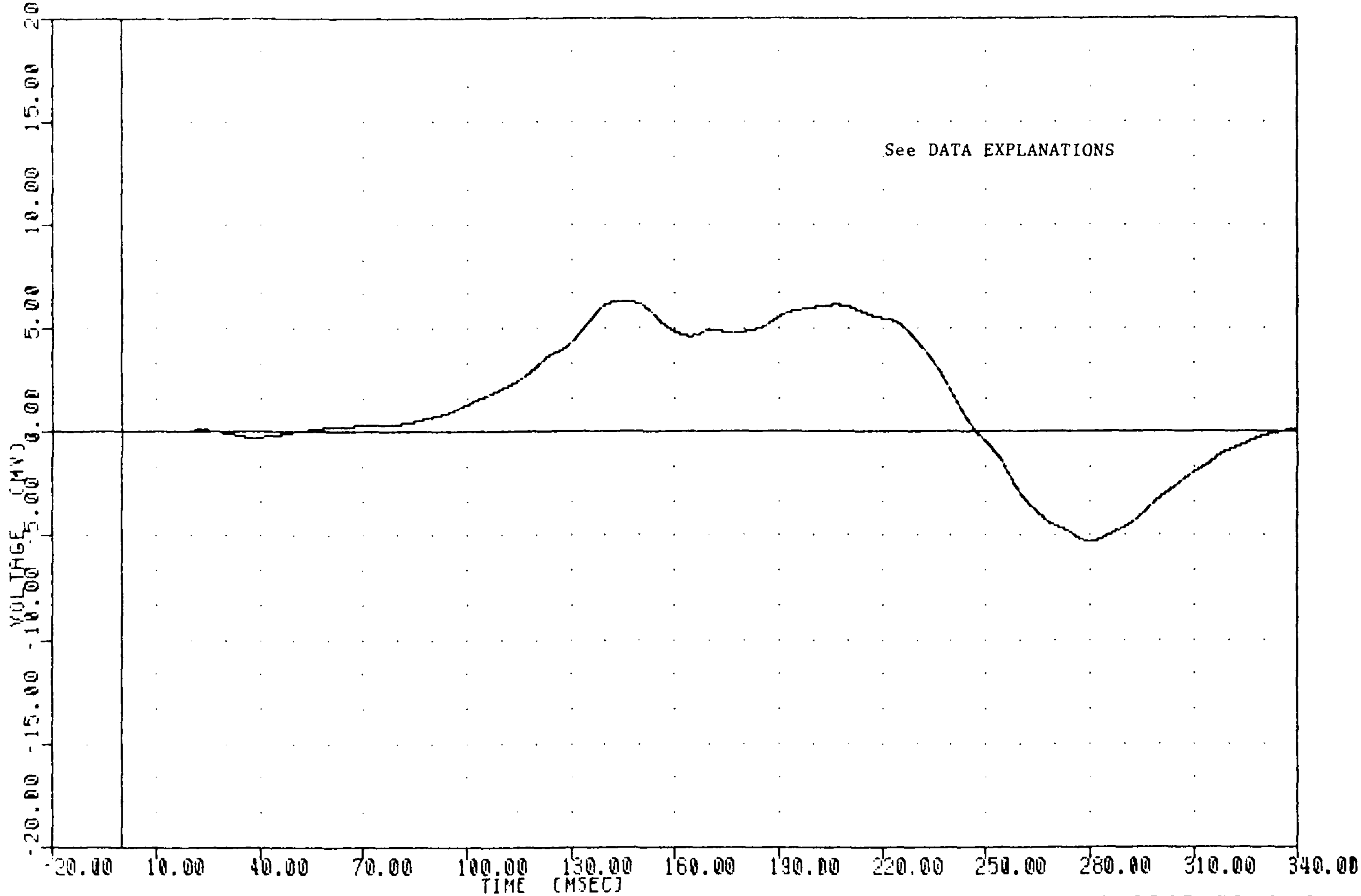
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT D CENTER DUMMY INBOARD LAP BELT LOAD



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
PORT OUTBOARD BEAM STRAIN

FAA , TEST 01
CRASH SIMULATION
87278
FIBS

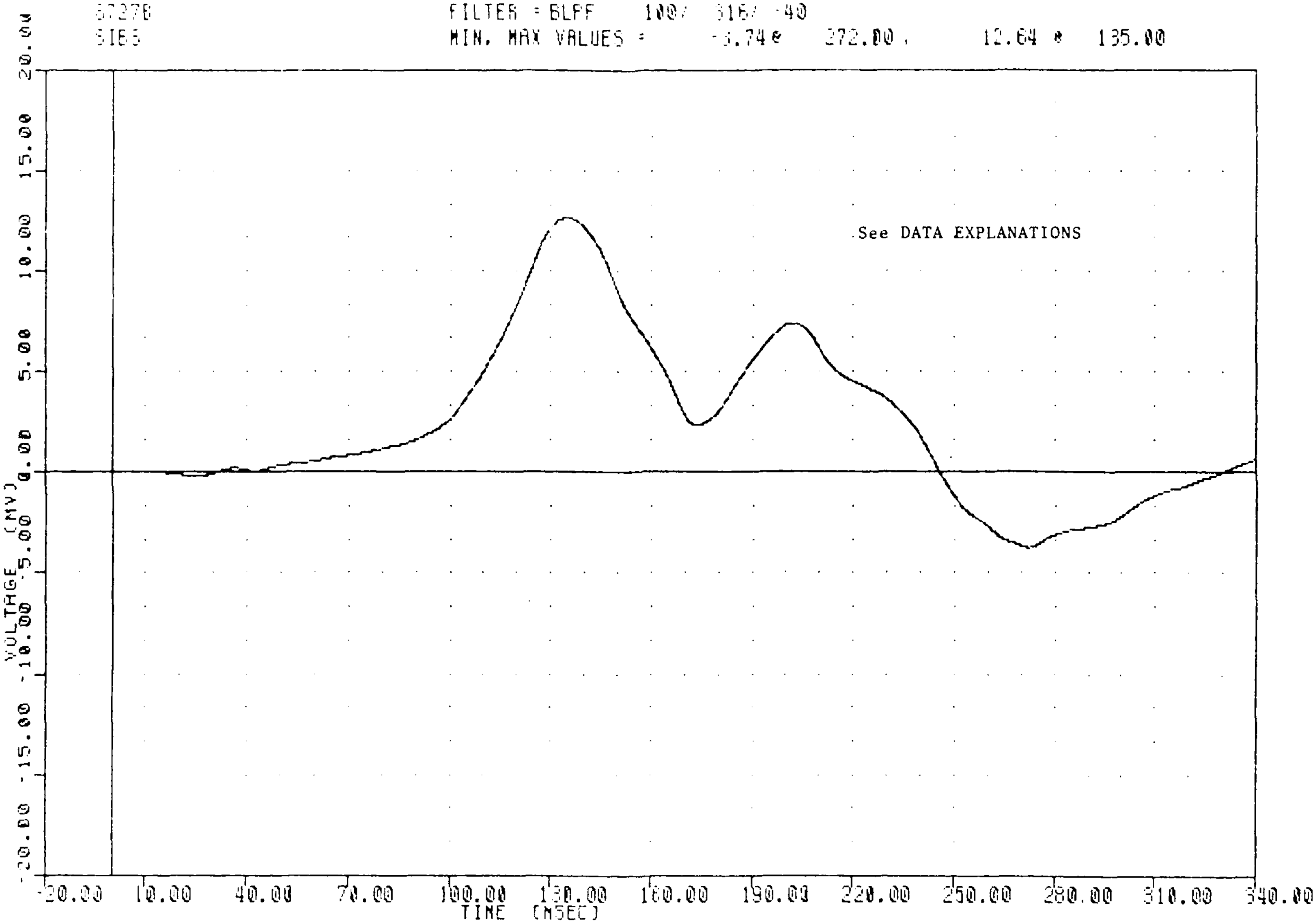
FILTER = 6LPF 100/ 316/ -40
MIN, MAX VALUES = -5.27 @ 280.00 , 6.29 @ 143.75



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
PORT INBOARD BEAM STRAIN

FAA , TEST 21
CRASH SIMULATION
67278
SIBS

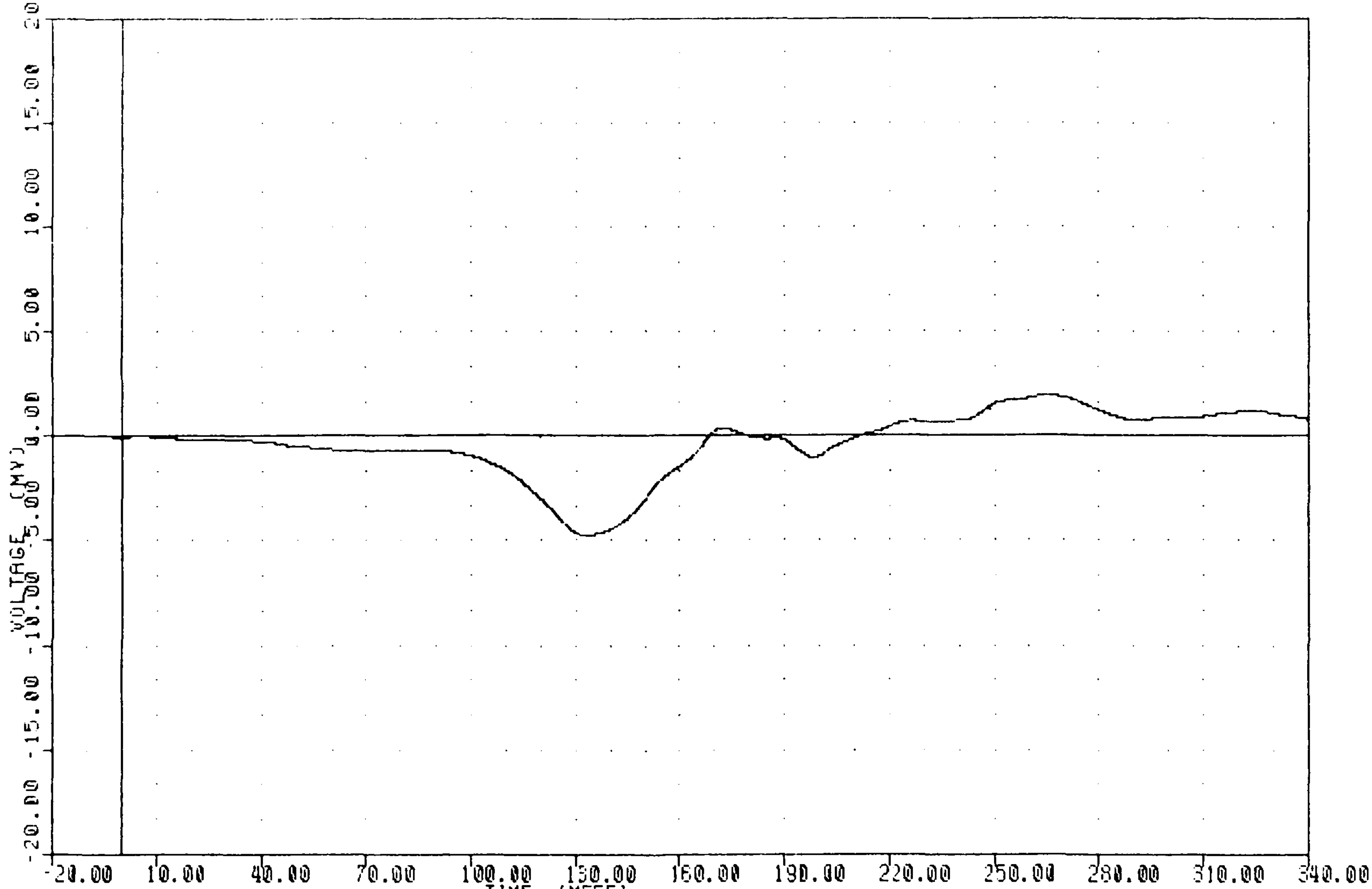
FILTER = BLPF 100/ 316/ 40
MIN, MAX VALUES = -3.74 @ 272.00 , 12.64 @ 135.00



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD INBOARD BEAM STRAIN

FAA , TEST 01
CRASH SIMULATION
87278
SOBS

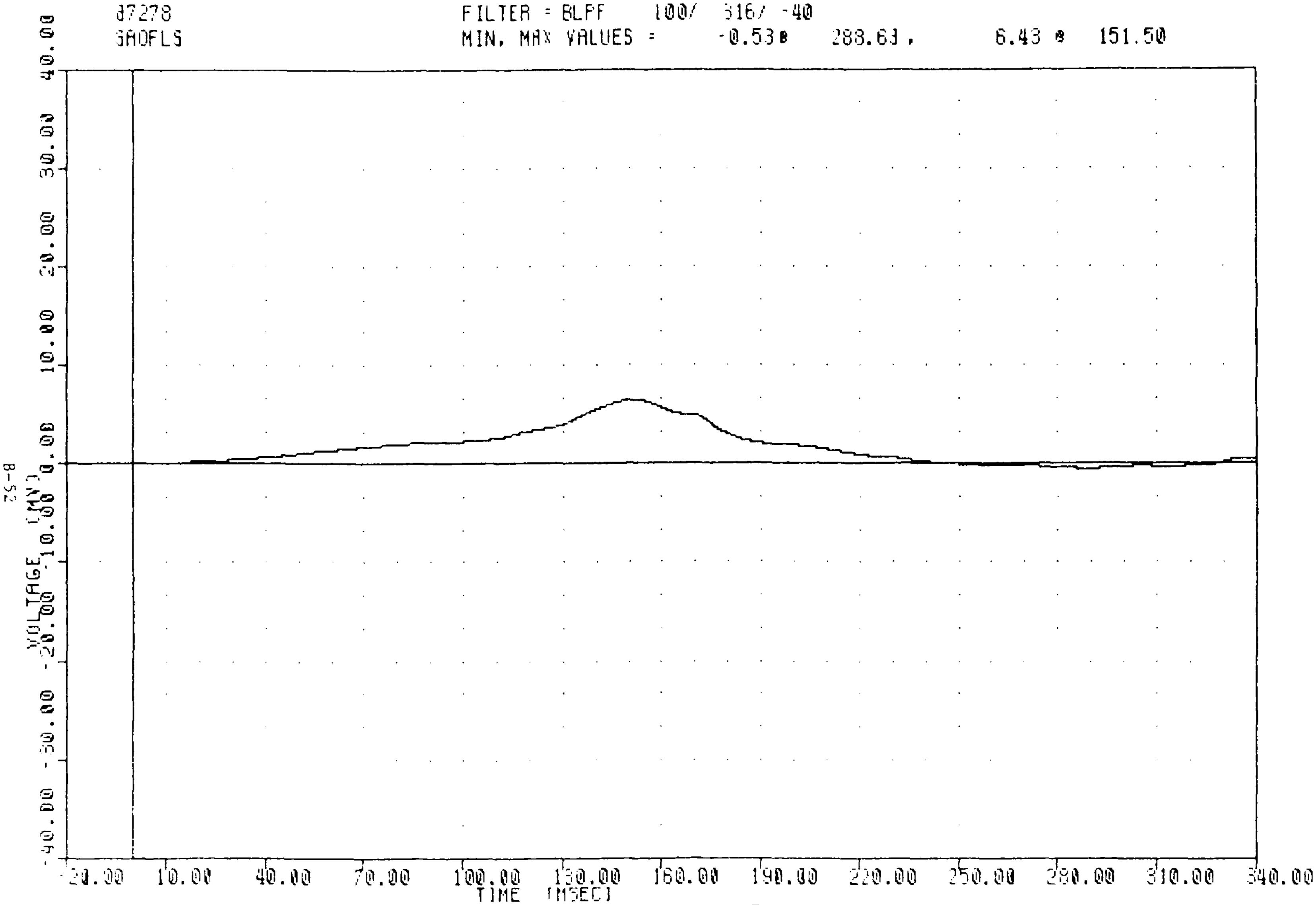
FILTER = ELFF 100/ 316/ -40
MIN, MAX VALUES = -4.74 @ 132.75 , 1.94 @ 265.38



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
STARBOARD OUTBOARD BEAM STRAIN

FAA , TEST 01
CRASH SIMULATION
87278
SADFLS

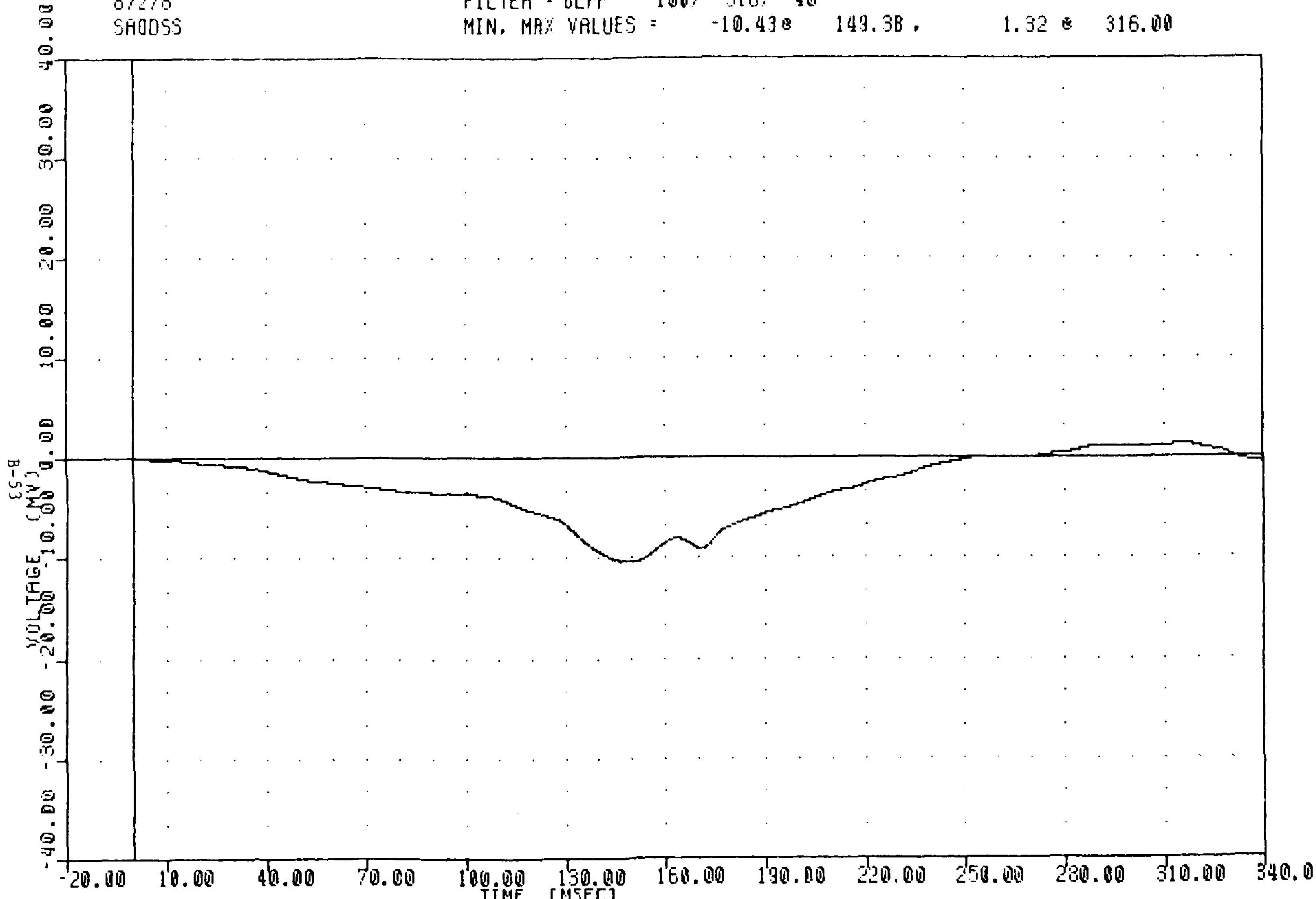
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.53 @ 288.63 , 6.43 @ 151.50



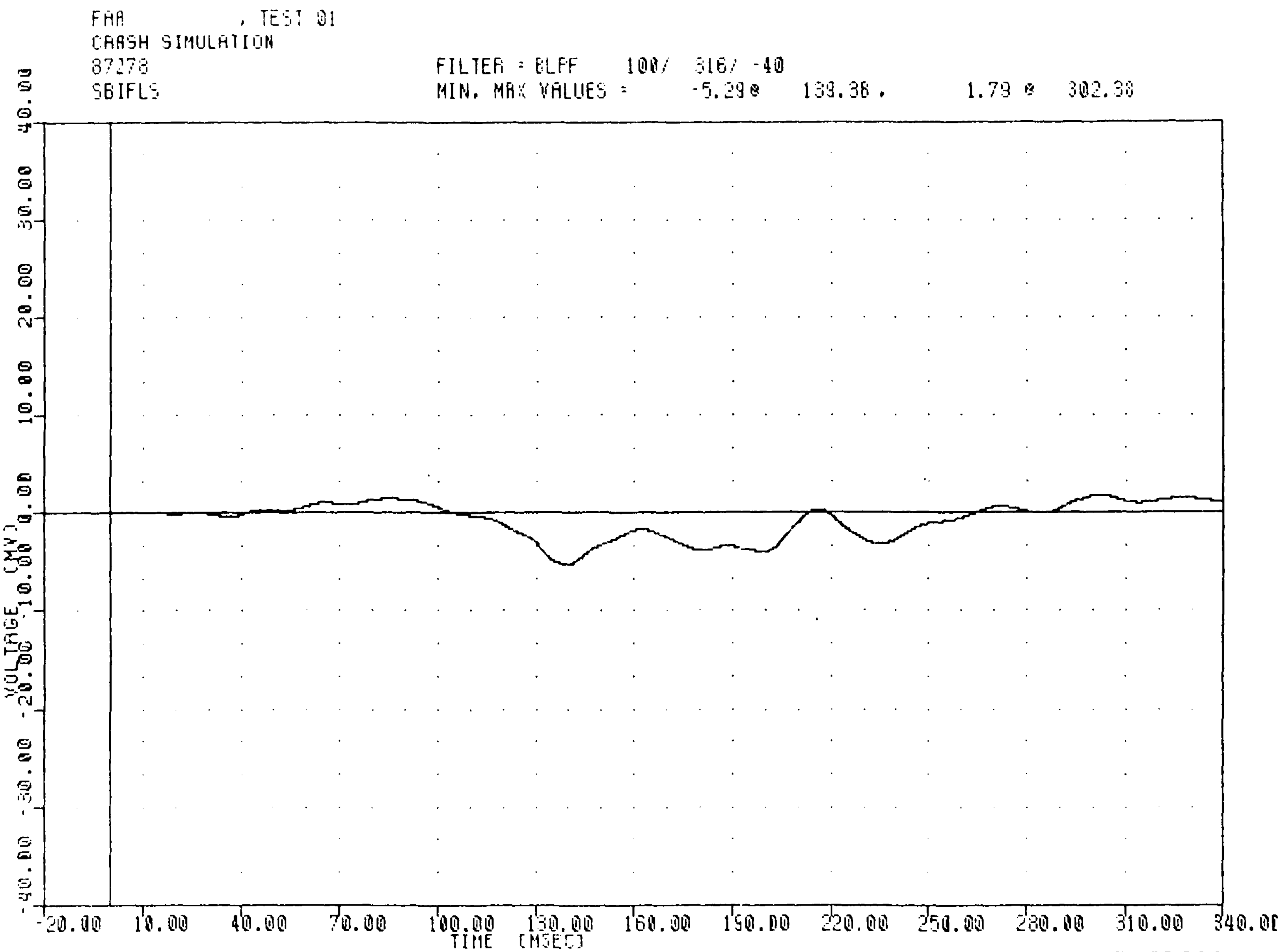
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT A OUTBOARD FORWARD LEG STRAIN

FAA , TEST 01
CRASH SIMULATION
87278
SAODSS

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -10.43 @ 149.38 , 1.32 @ 316.00



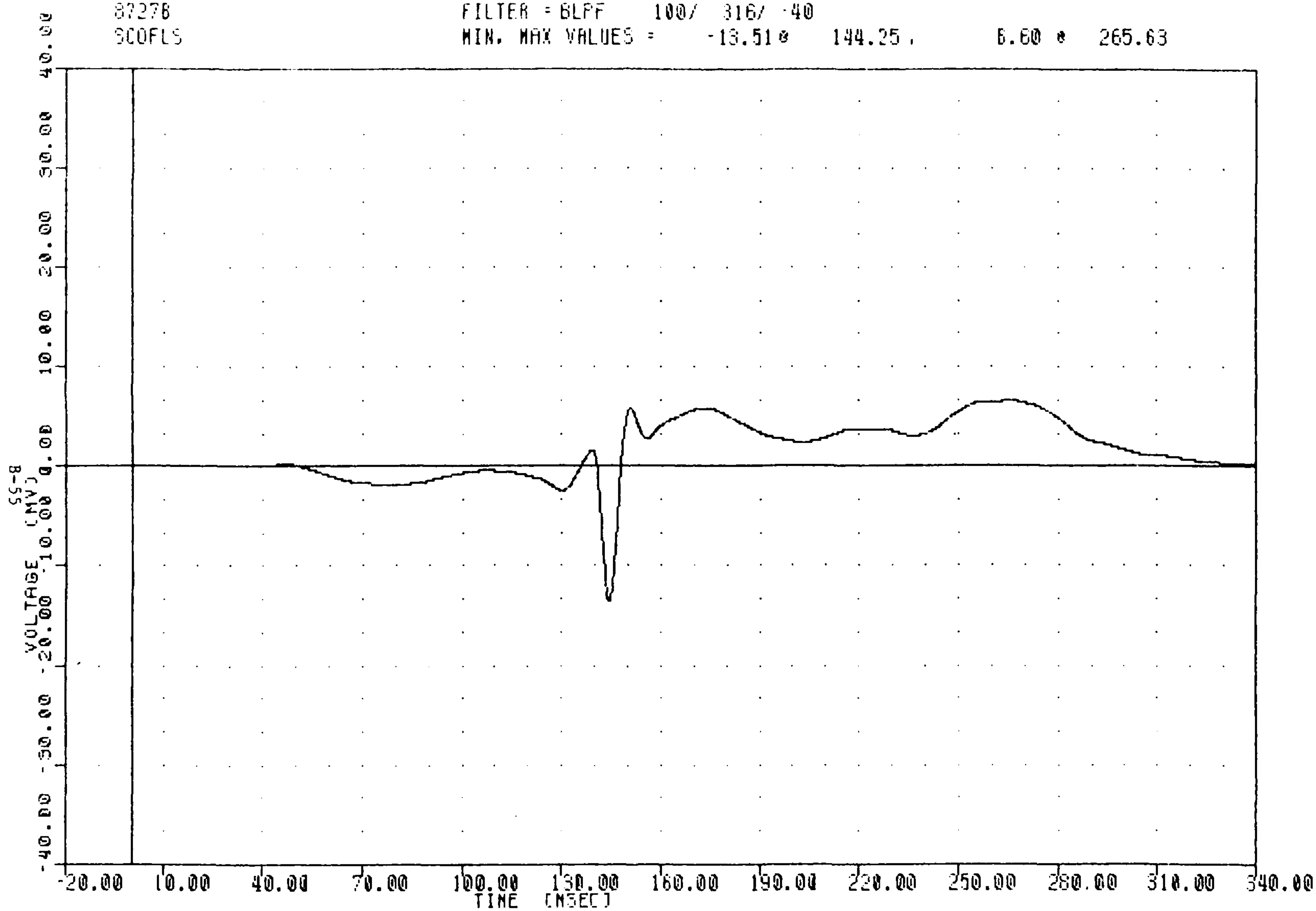
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT A OUTBOARD DIAGONAL STRUT STRAIN



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT B INBOARD FORWARD LEG STRAIN

FAA , TEST 01
CRASH SIMULATION
87278
SCOFLS

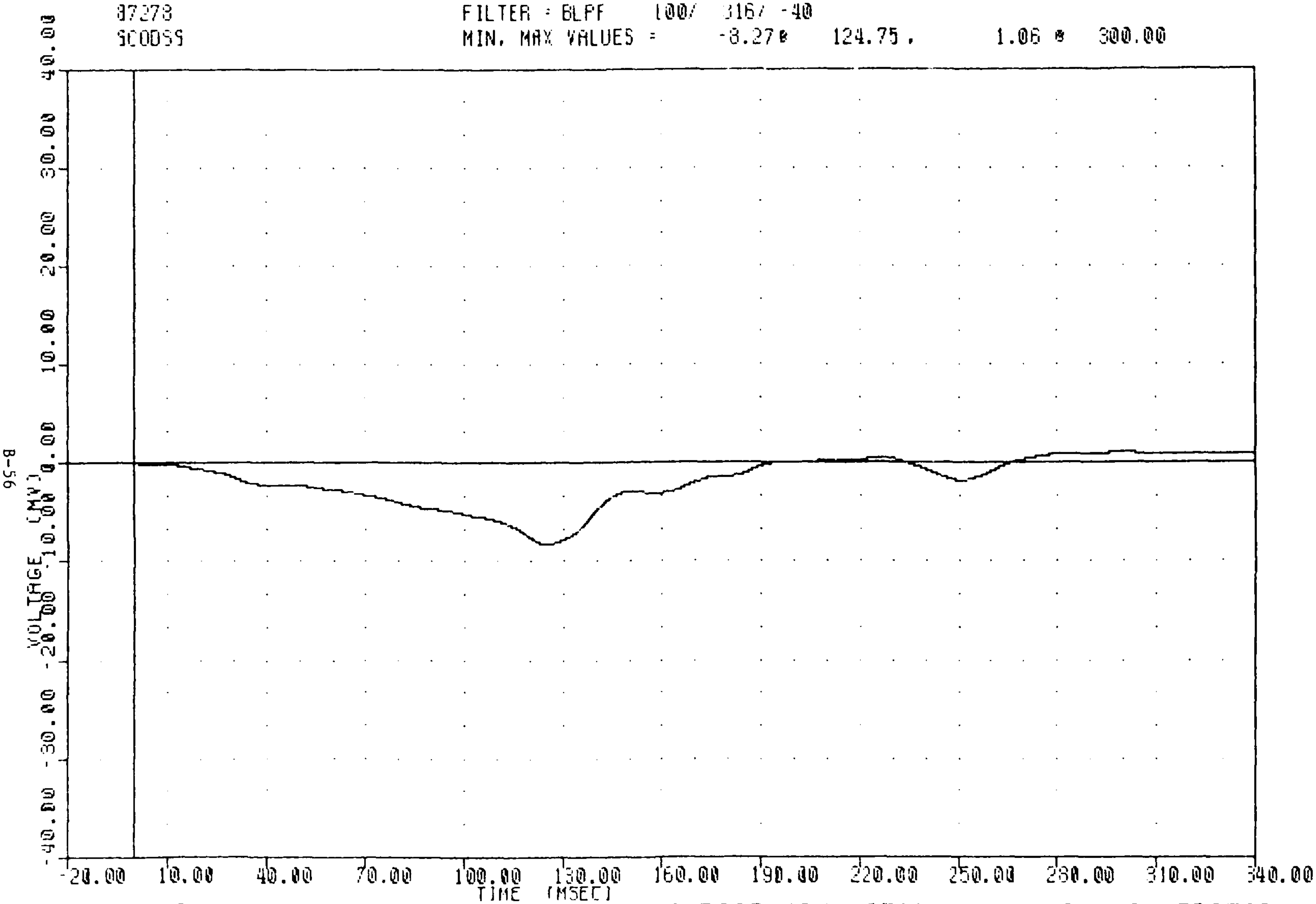
FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -13.51 @ 144.25 , 6.60 @ 265.63



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT C OUTBOARD FORWARD LEG STRAIN

FAA , TEST 01
CRASH SIMULATION
87278
SCODS9

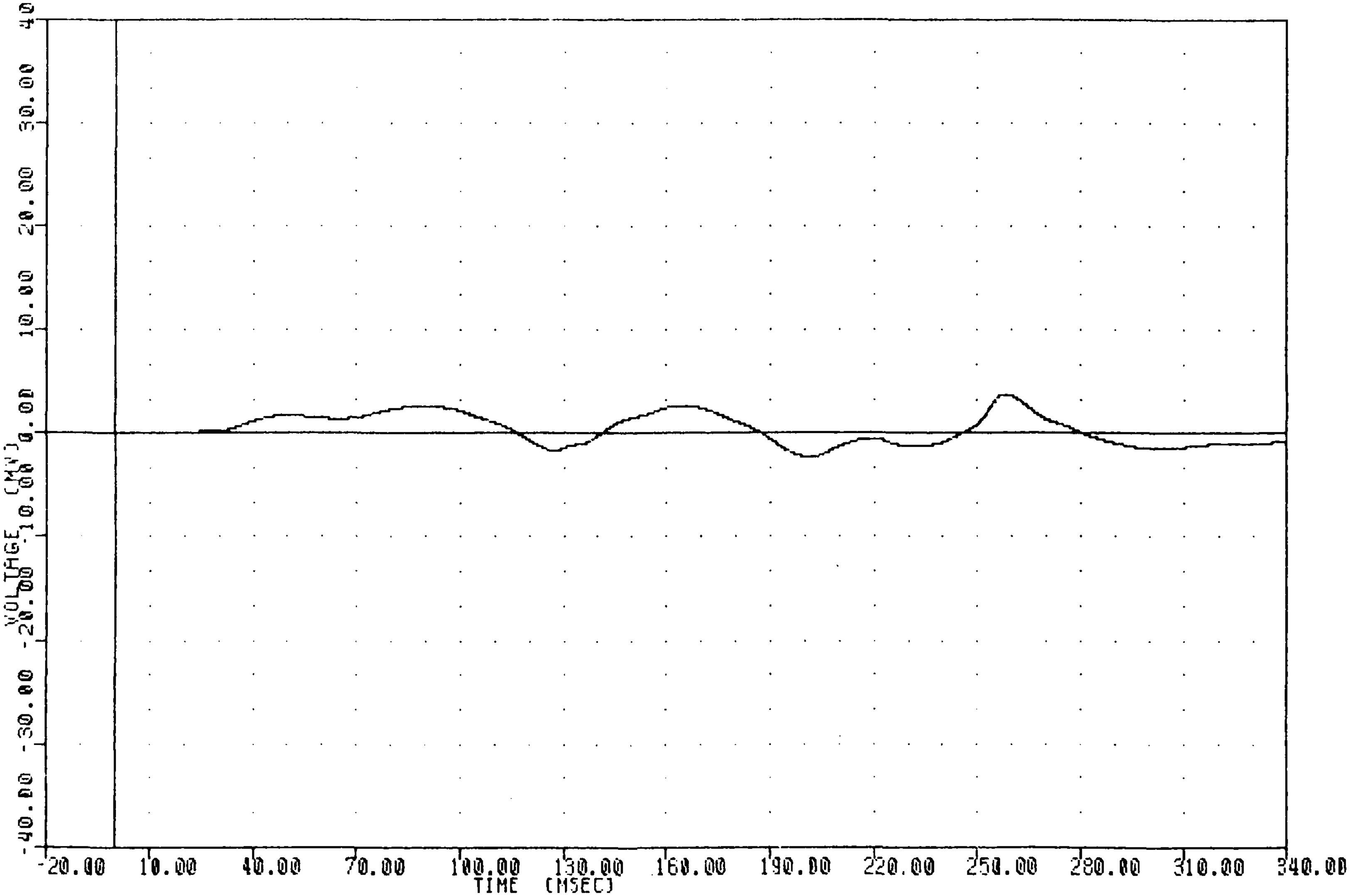
FILTER : BLPF 100/ 316/ -40
MIN, MAX VALUES = -8.27 @ 124.75 , 1.06 @ 300.00



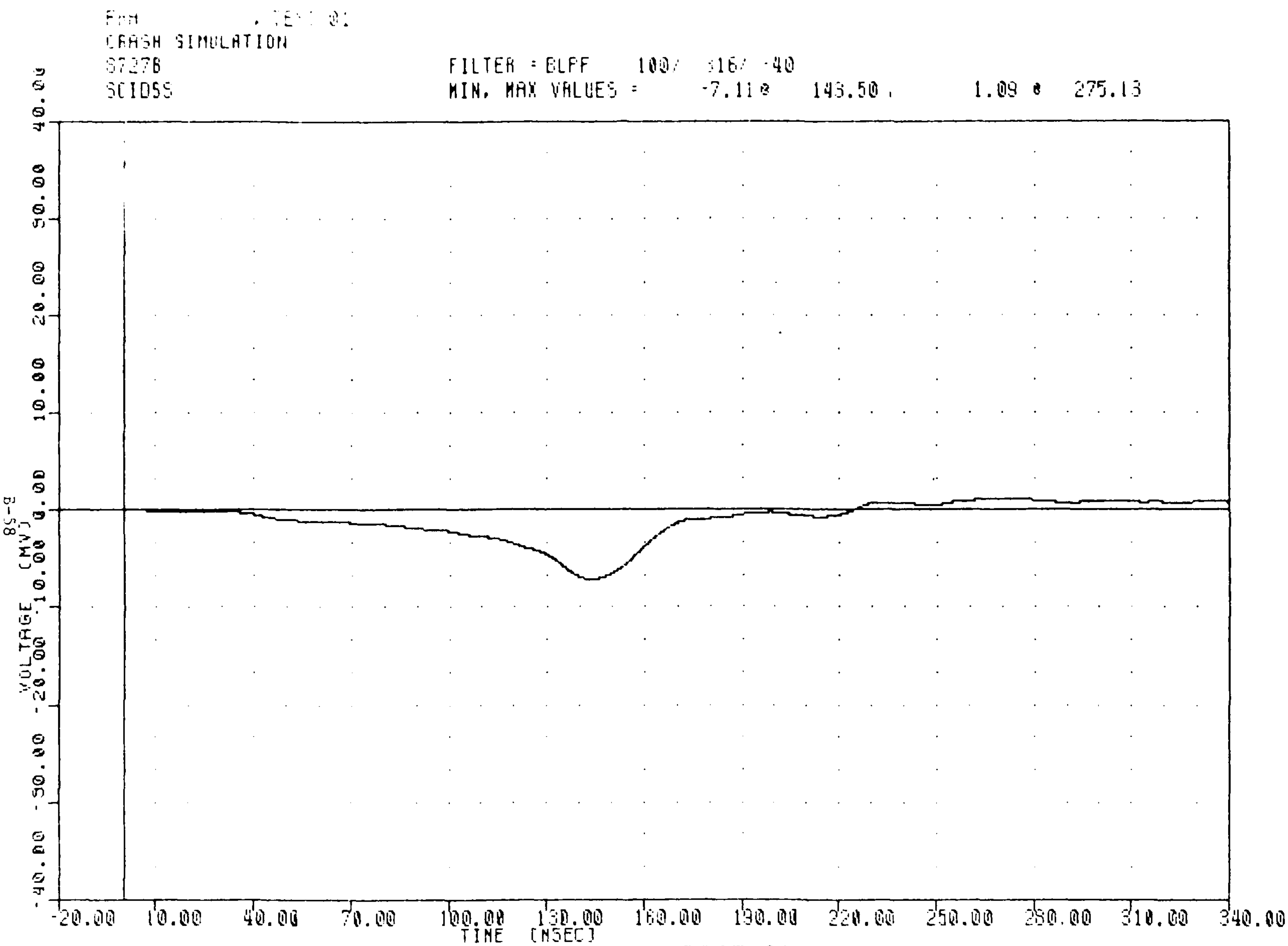
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT C OUTBOARD DIAGONAL STRUT STRAIN

FAA , TEST 01
CRASH SIMULATION
87278
SCIFLS

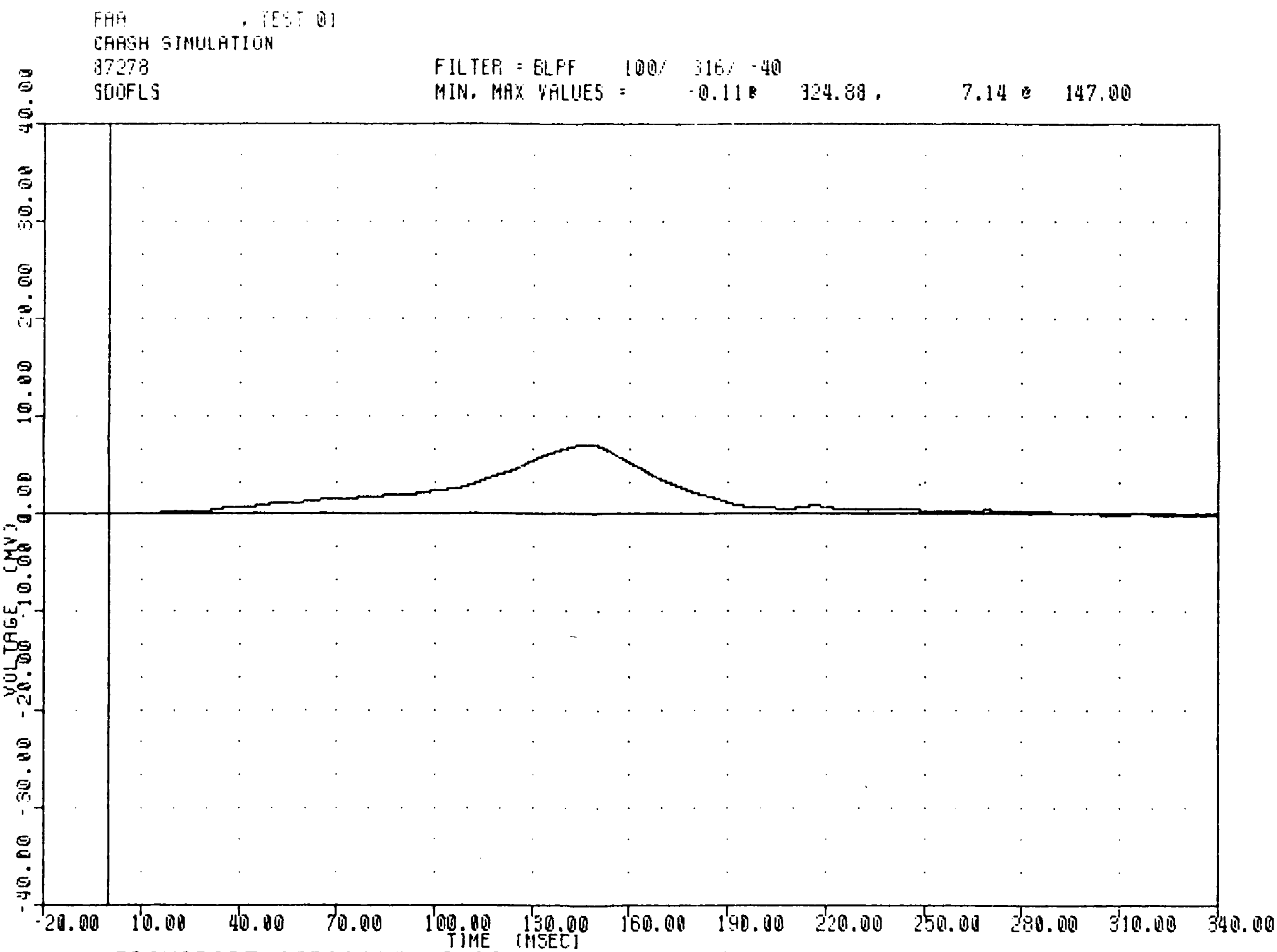
FILTER = BLPF 100/ 516/ -40
MIN, MAX VALUES = -2.29 @ 201.63 , 3.76 @ 258.25



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT C INBOARD FORWARD LEG STRAIN



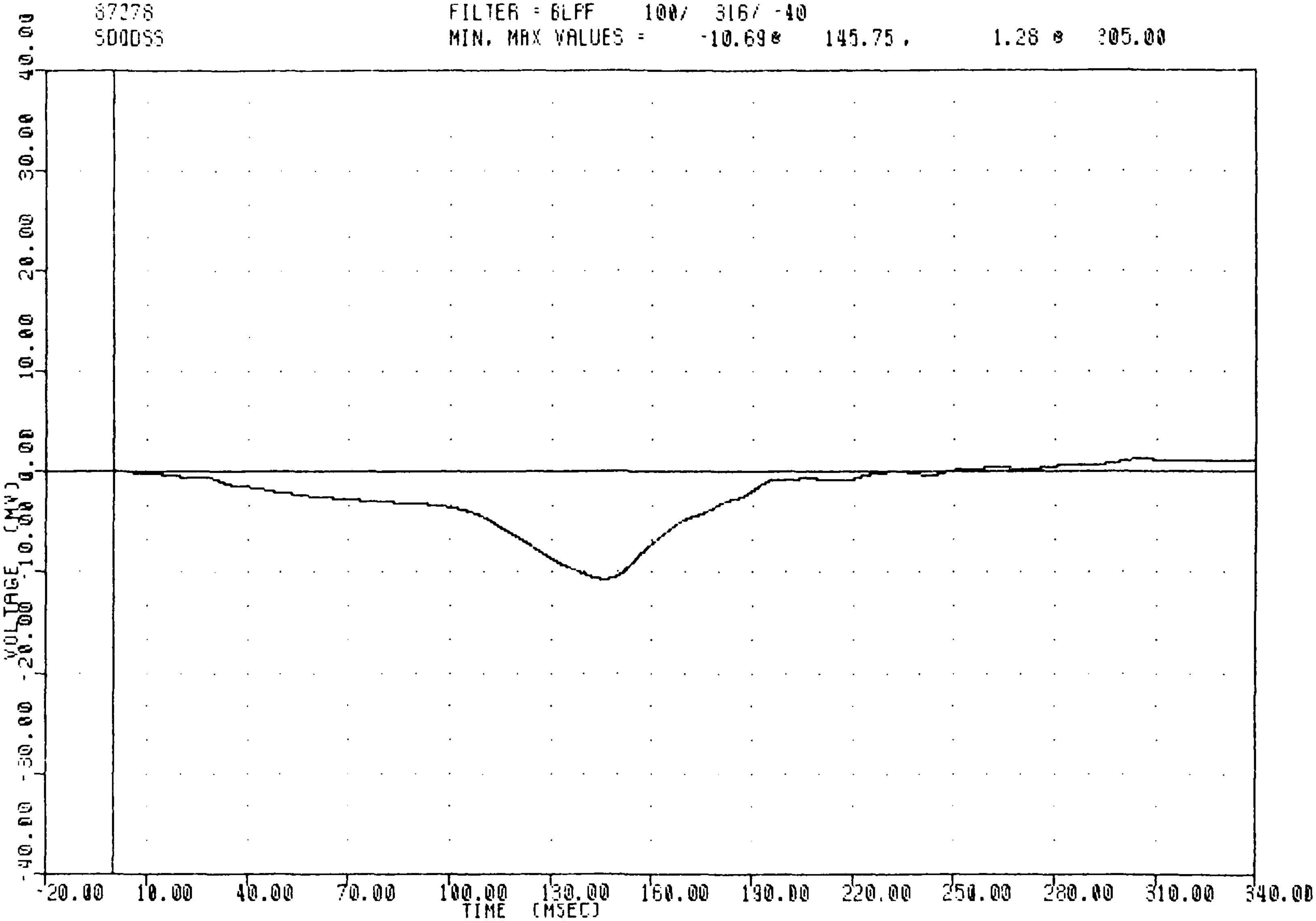
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT C INBOARD DIAGONAL STRUT STRAIN



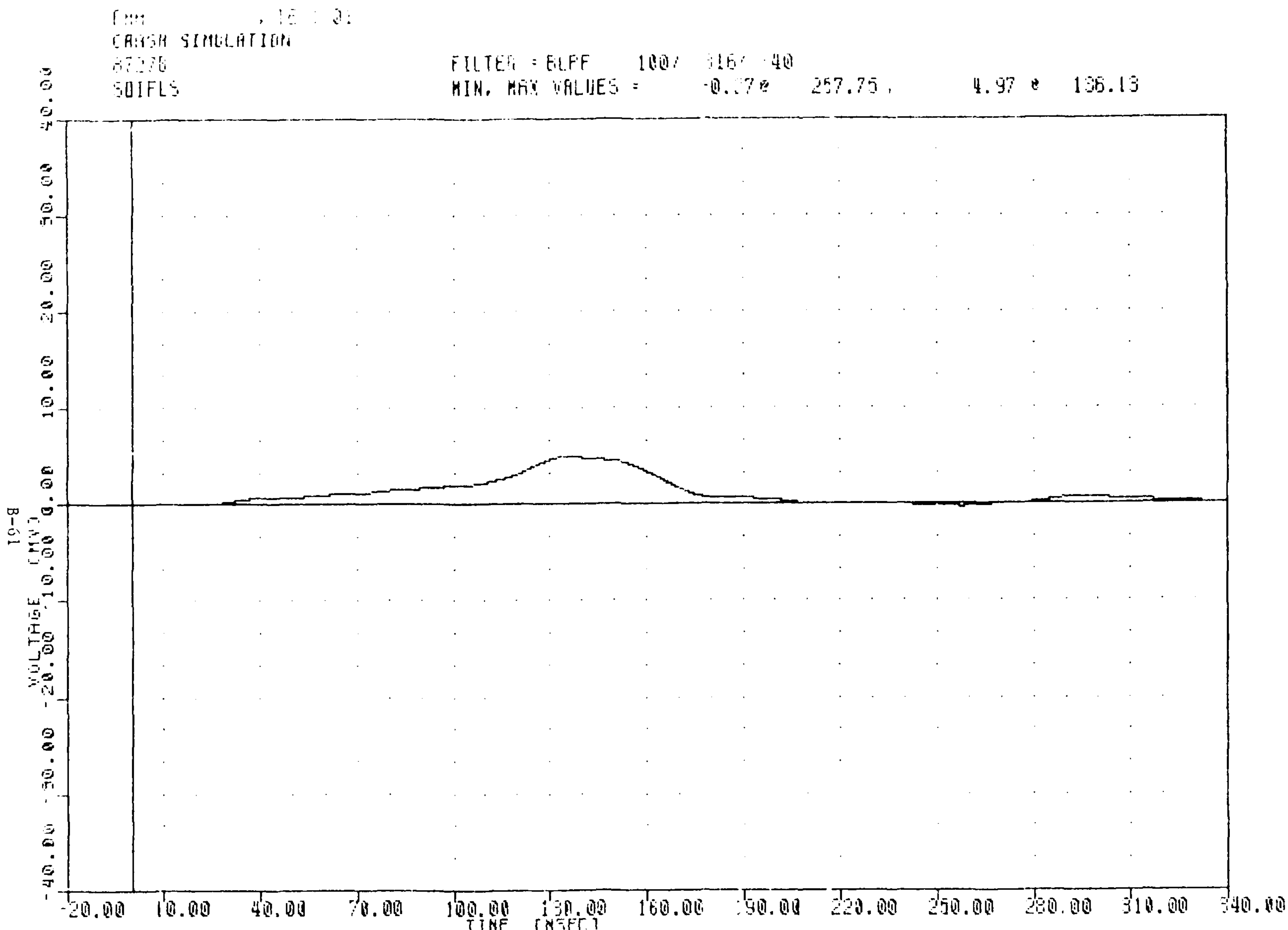
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT D OUTBOARD FORWARD LEG STRAIN

FAA , TEST 01
CRASH SIMULATION
87278
SOODSS

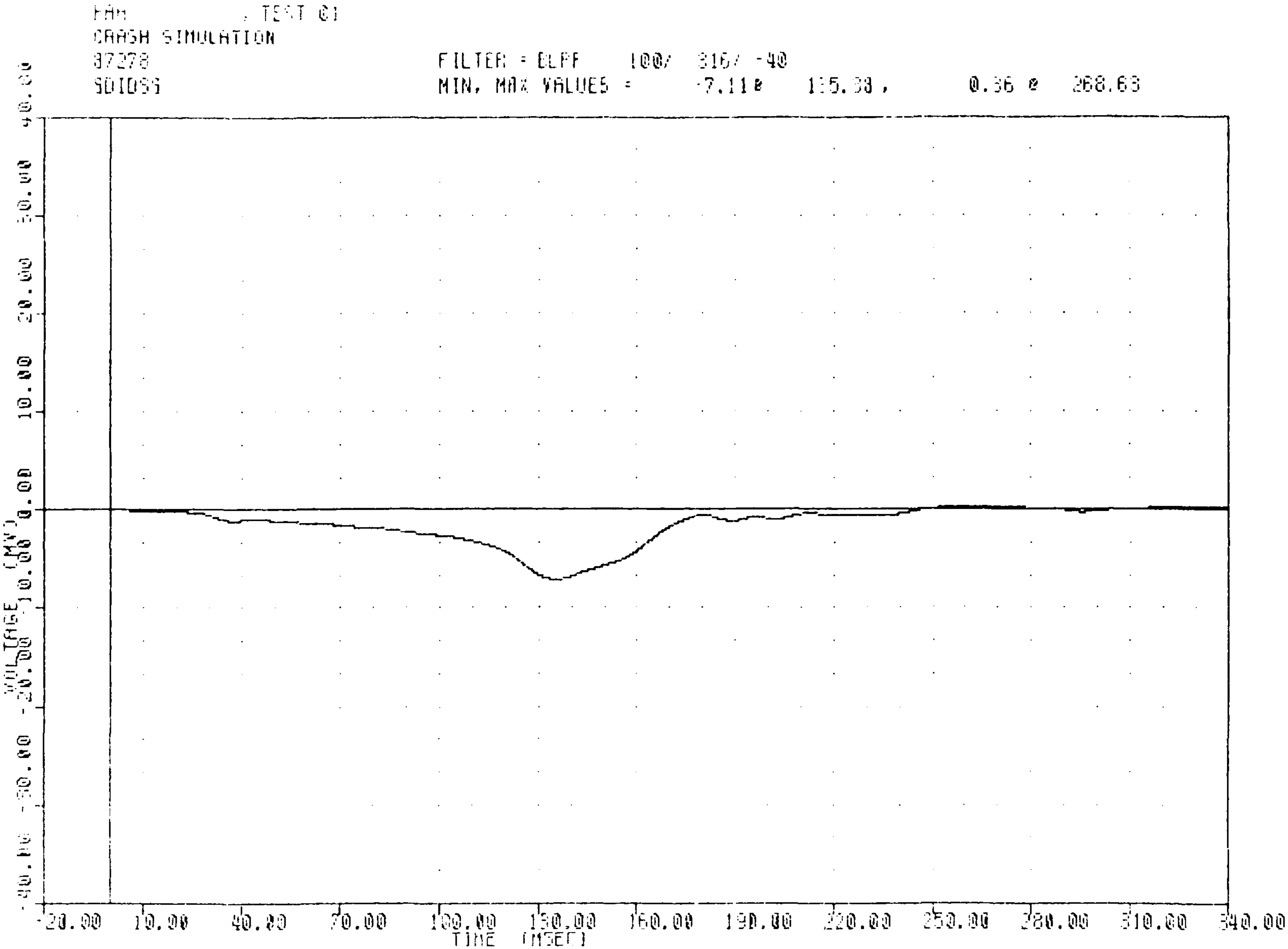
FILTER = 6LFF 100/ 316/ -40
MIN, MAX VALUES = -10.69 @ 145.75 , 1.28 @ 305.00



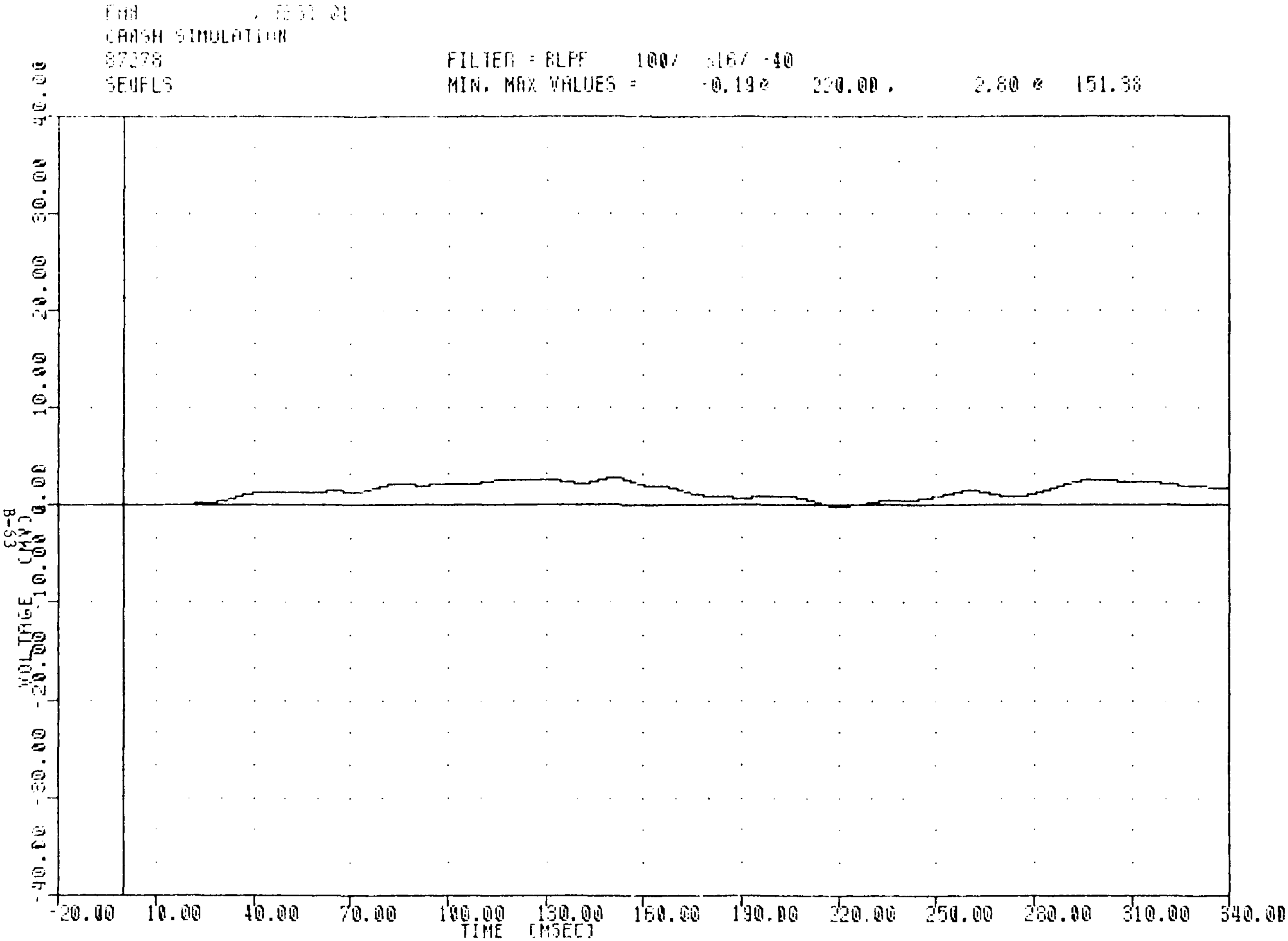
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT D OUTBOARD DIAGONAL STRUT STRAIN



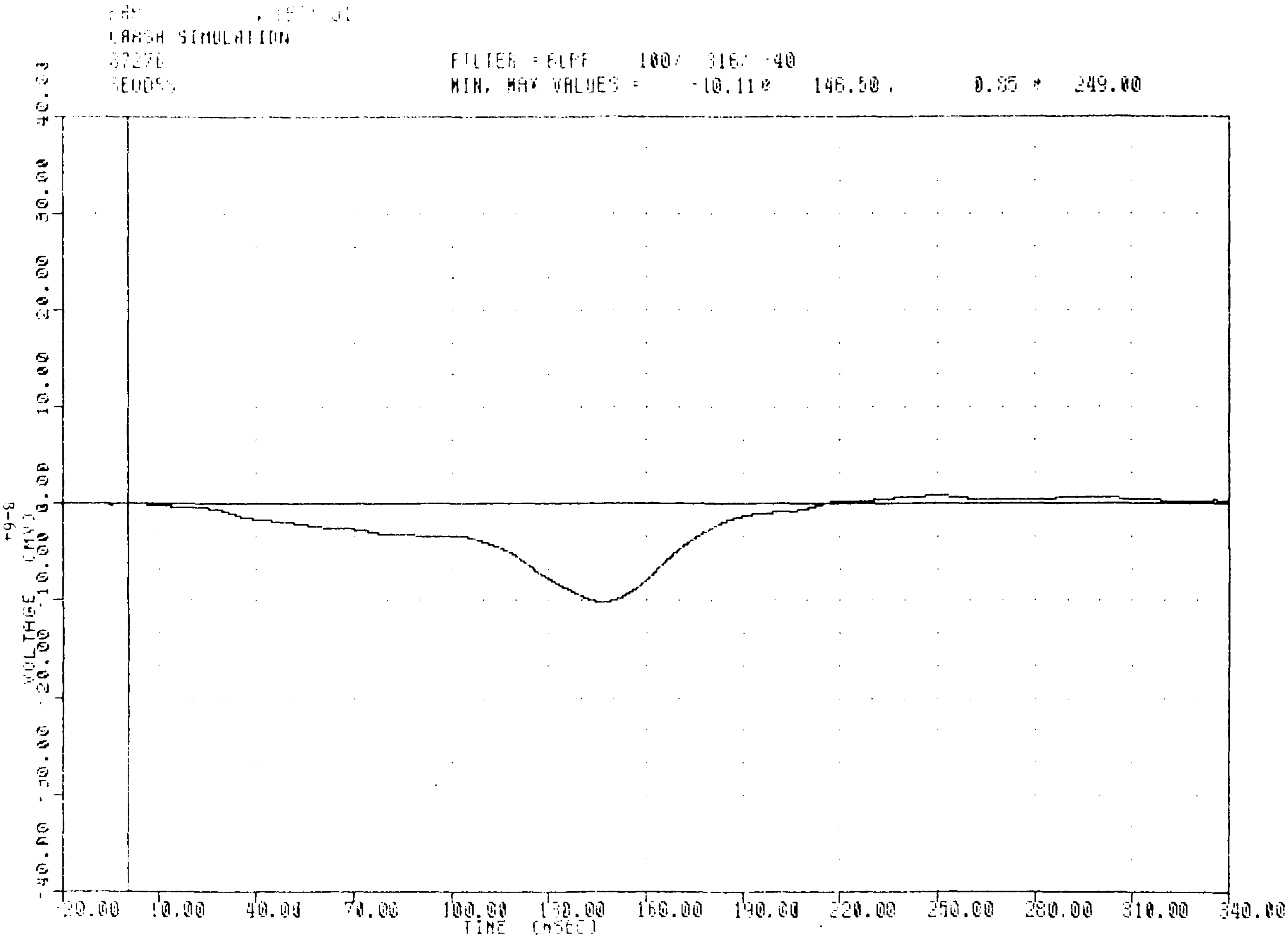
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT D INBOARD FORWARD LEG STRAIN



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT D INBOARD DIAGONAL STRUT STRAIN

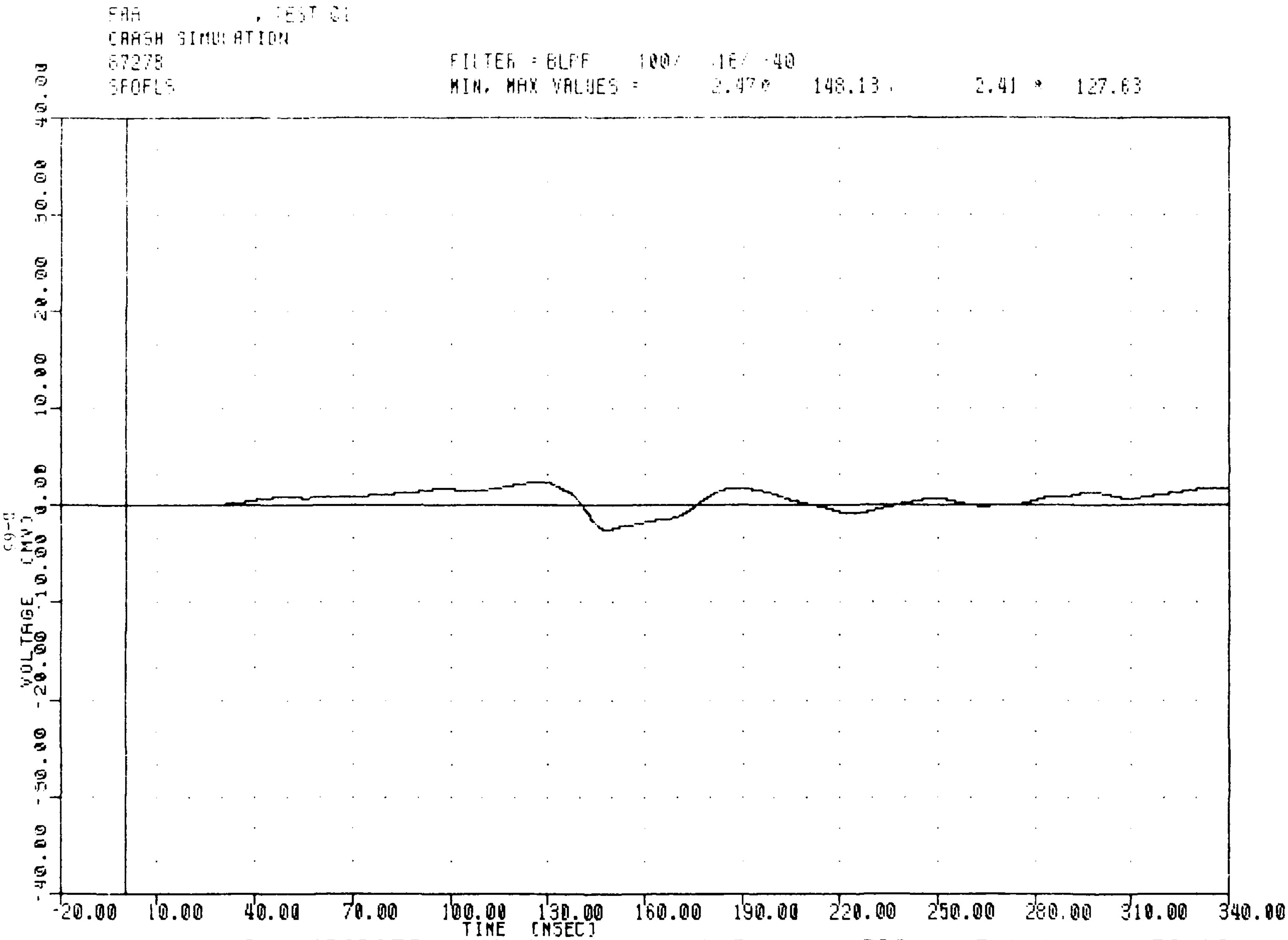


TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT E OUTBOARD FORWARD LEG STRAIN



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION

STRAIN OUTBOARD DIAGONAL STRUT STRAIN

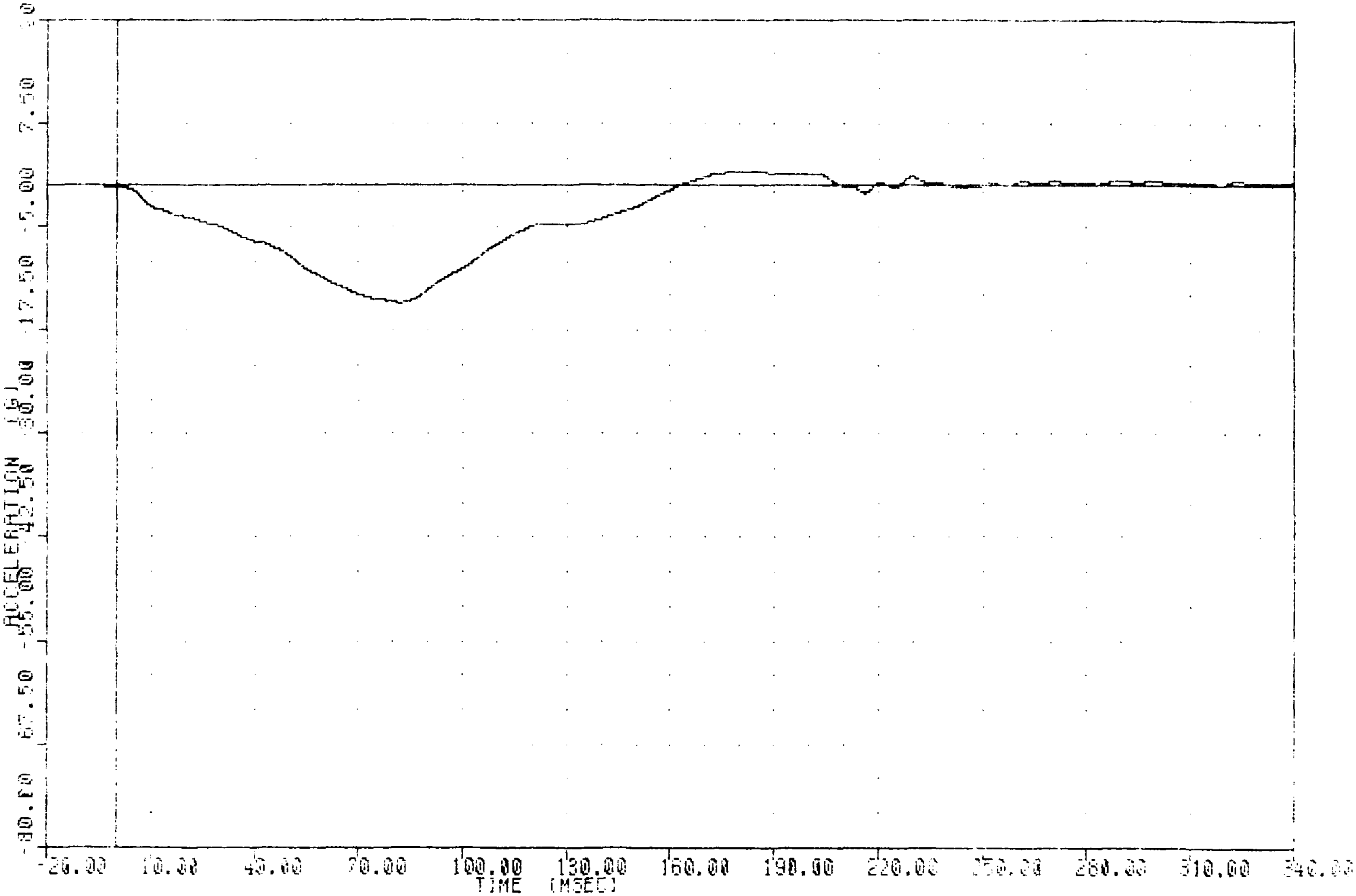


TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 7.4 G ACCELERATION
SEAT F OUTBOARD FORWARD LEG STRAIN

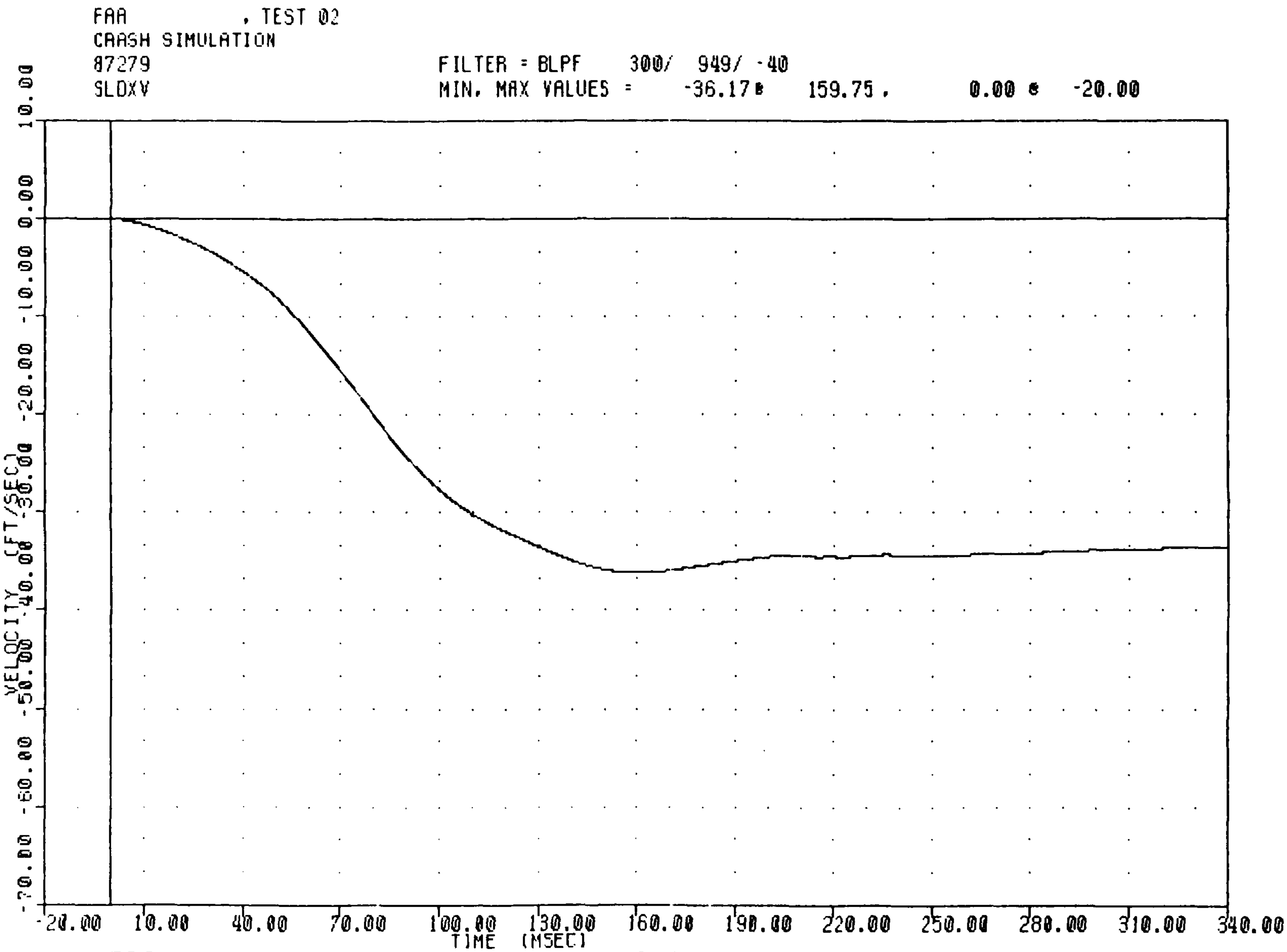
TEST 02 DATA PLOTS

CRASH SIMULATION
07279
SLOWS

FILTER = BLFF 100/ 216/ 40
MIN, MAX VALUES = -14.19 @ 81.75 , 1.69 @ 180.38



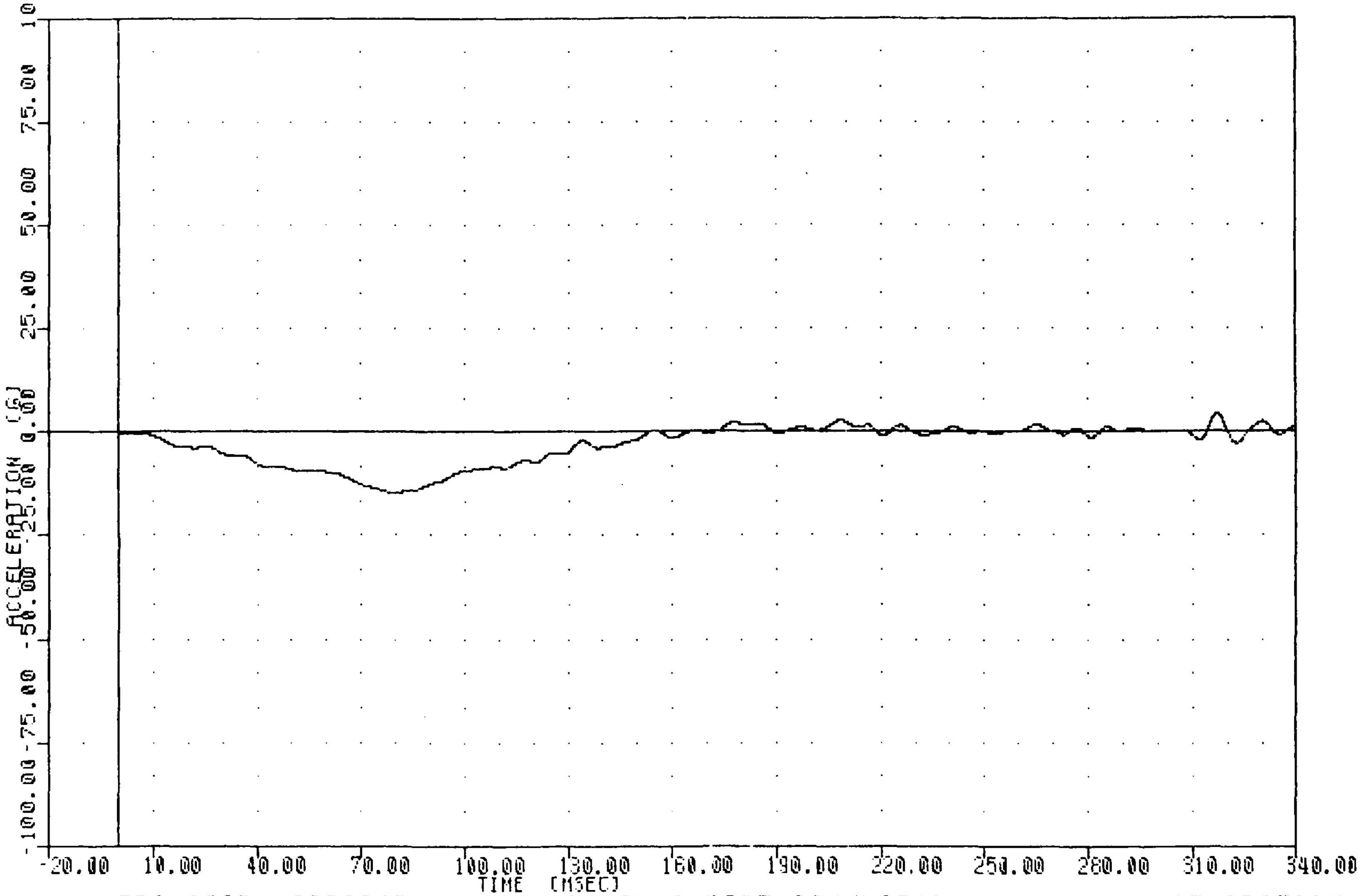
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SLED LONGITUDINAL ACCELERATION



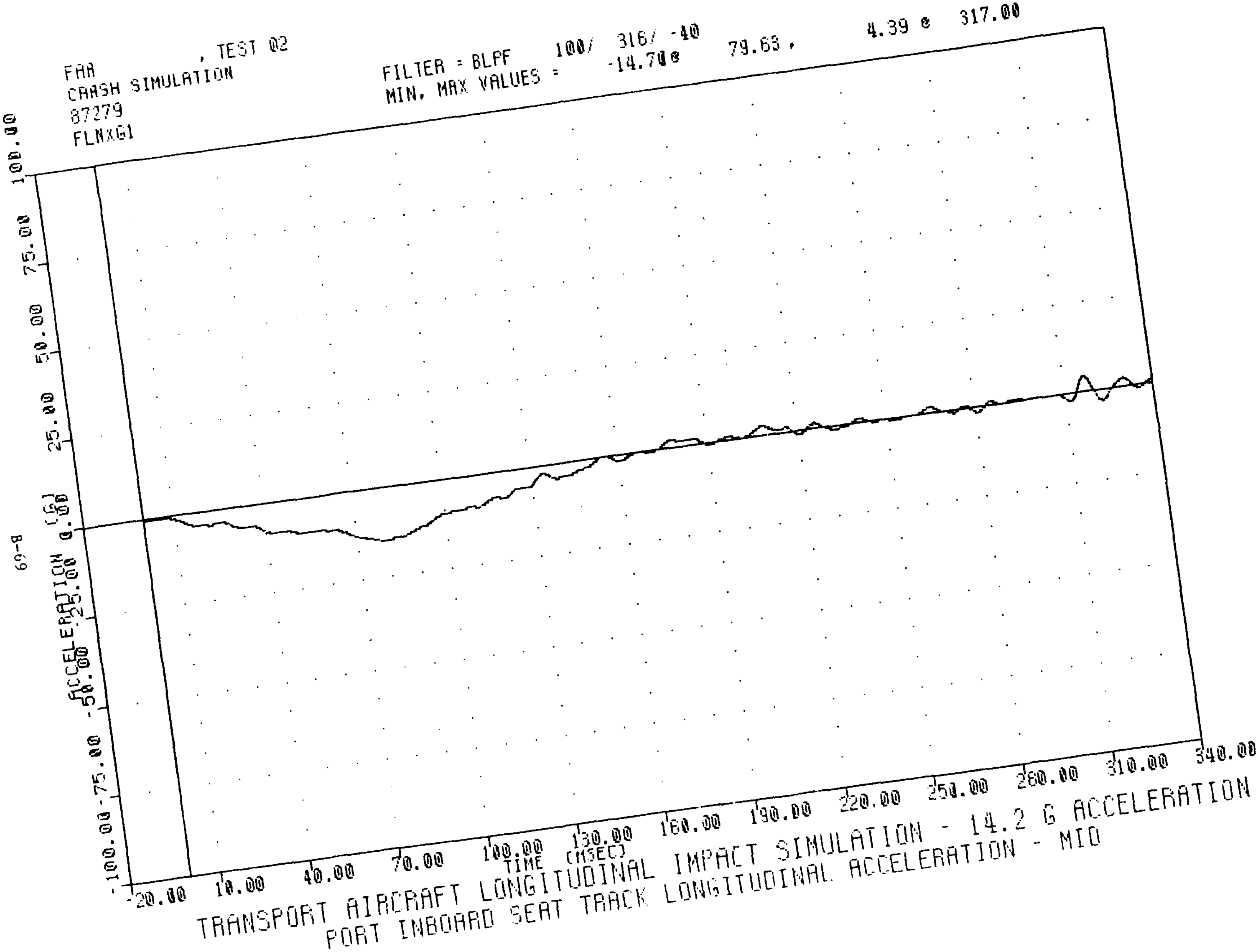
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SLED LONGITUDINAL VELOCITY

FAA , TEST 02
CRASH SIMULATION
87279
FLNXG1

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -14.70 @ 79.63 , 4.39 @ 317.00

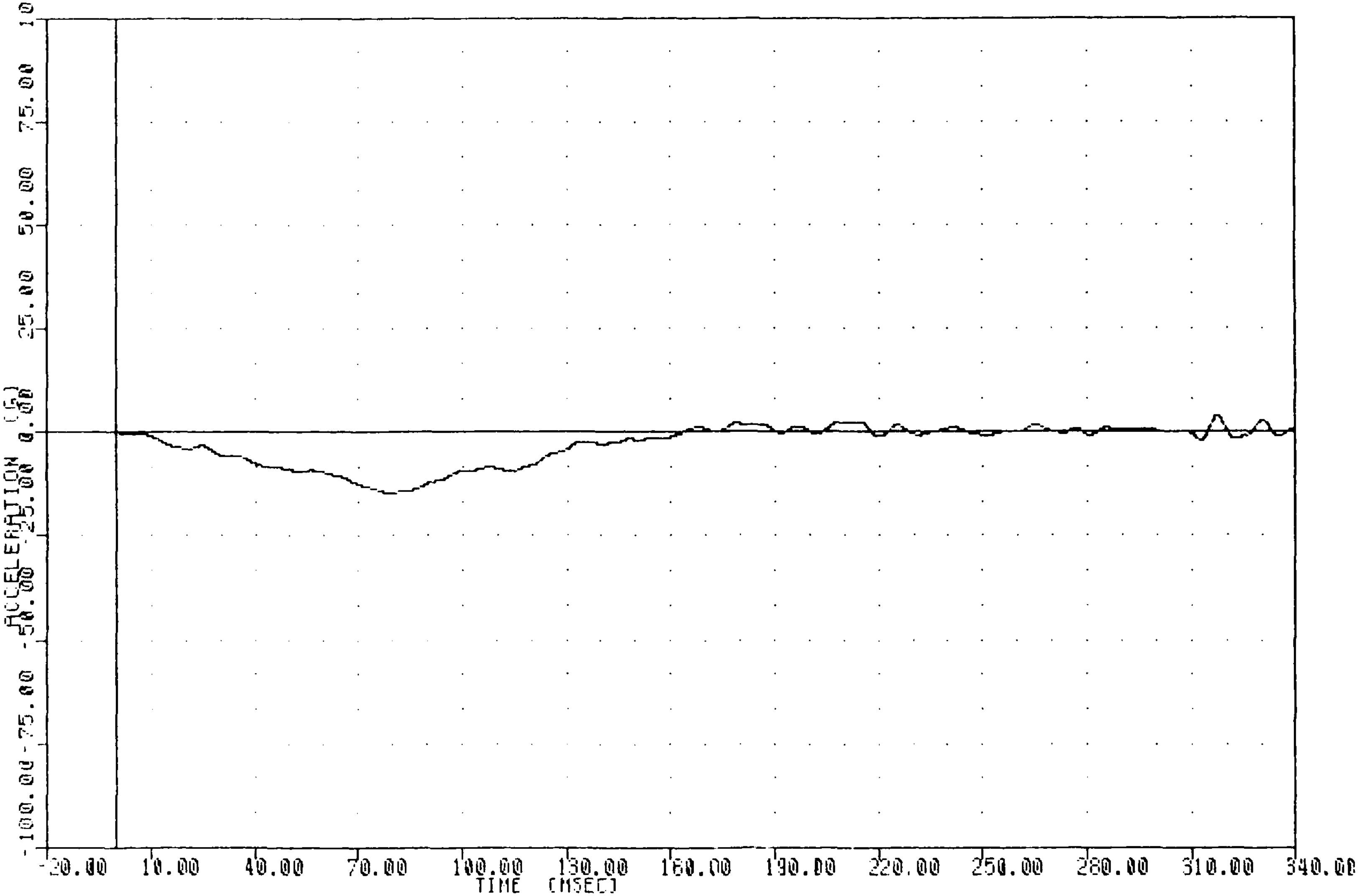


TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
PORT INBOARD SEAT TRACK LONGITUDINAL ACCELERATION - MID


FAA , TEST 02
CRASH SIMULATION
87279
FLNXG1
FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -14.70 @ 79.63 , 4.39 @ 317.00
100.00
75.00
50.00
25.00
0.00
-25.00
-50.00
-75.00
-100.00
ACCELERATION (G)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
PORT INBOARD SEAT TRACK LONGITUDINAL ACCELERATION - MID

FAA , TEST 02
CRASH SIMULATION
87279
FLAX62

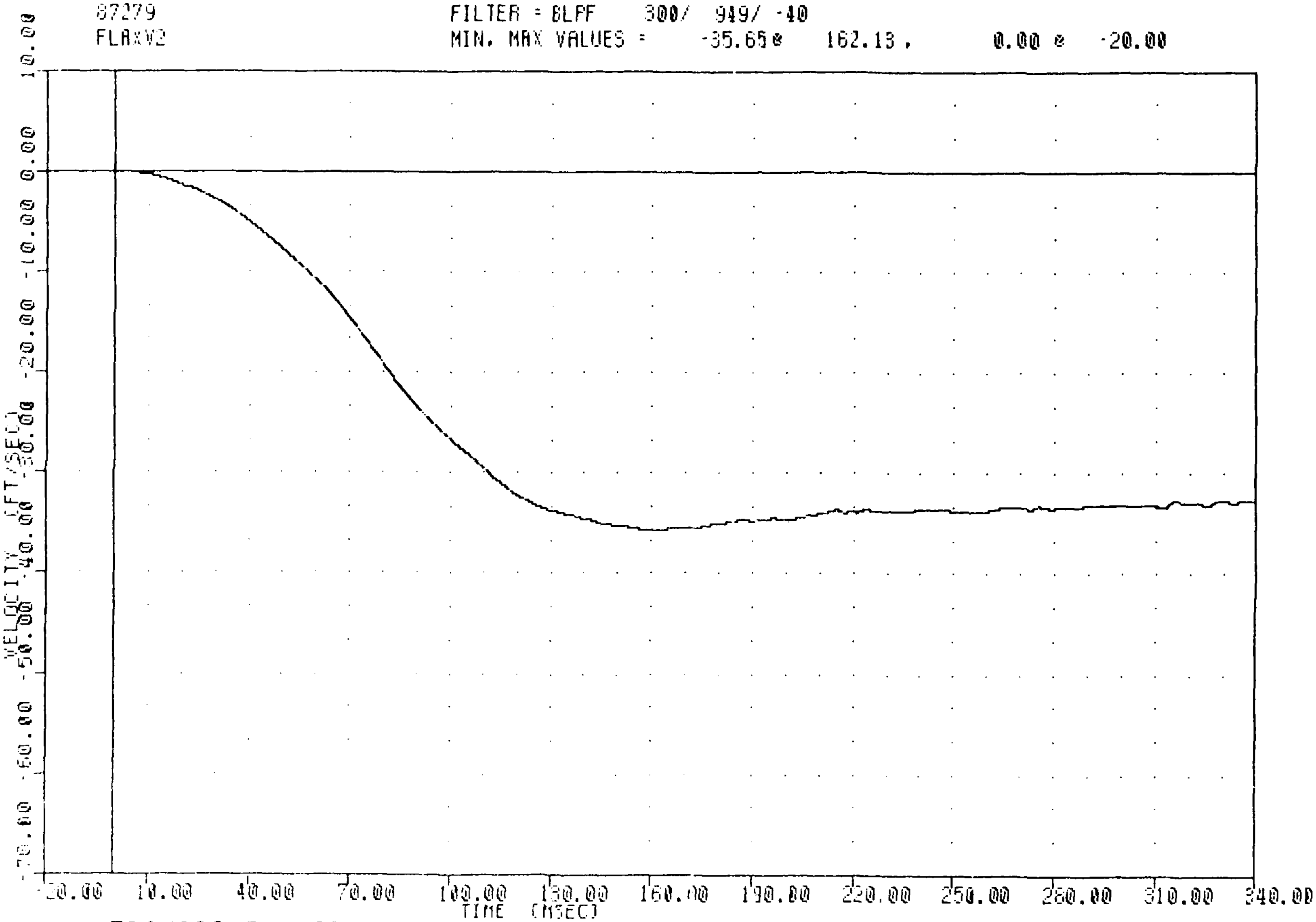
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -14.68 @ 79.13 , 3.84 @ 317.38



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD INBOARD SEAT TRACK LONGITUDINAL ACCELERATION - AFT

FAA , TEST 02
CRASH SIMULATION
87279
FLAXV2

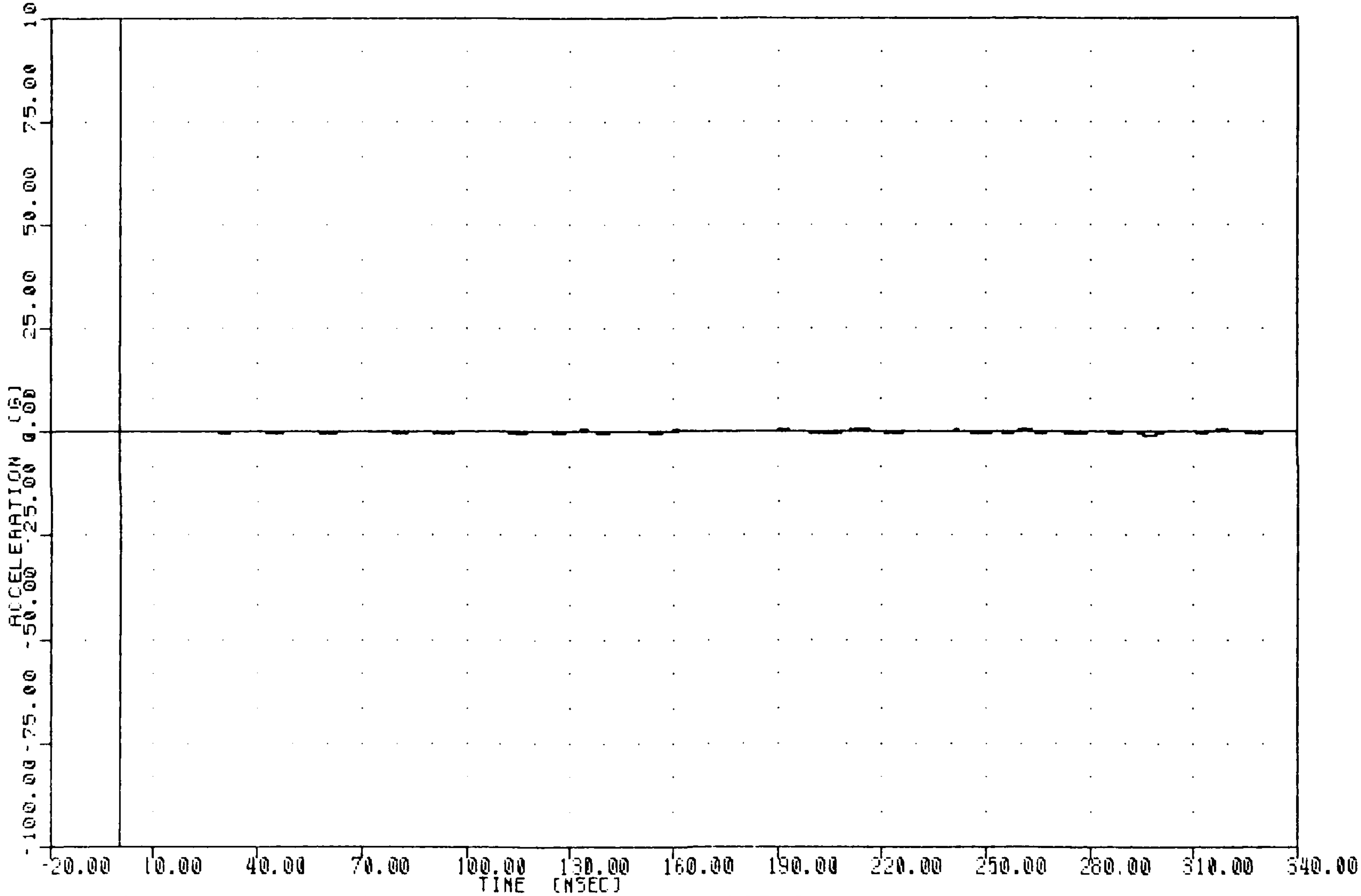
FILTER = BLPF 300/ 949/ -40
MIN. MAX VALUES = -35.65 @ 162.13 , 0.00 @ -20.00



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD INBOARD SEAT TRACK LONGITUDINAL VELOCITY - AFT

FAA , TEST 02
CRASH SIMULATION
87279
FLAY62

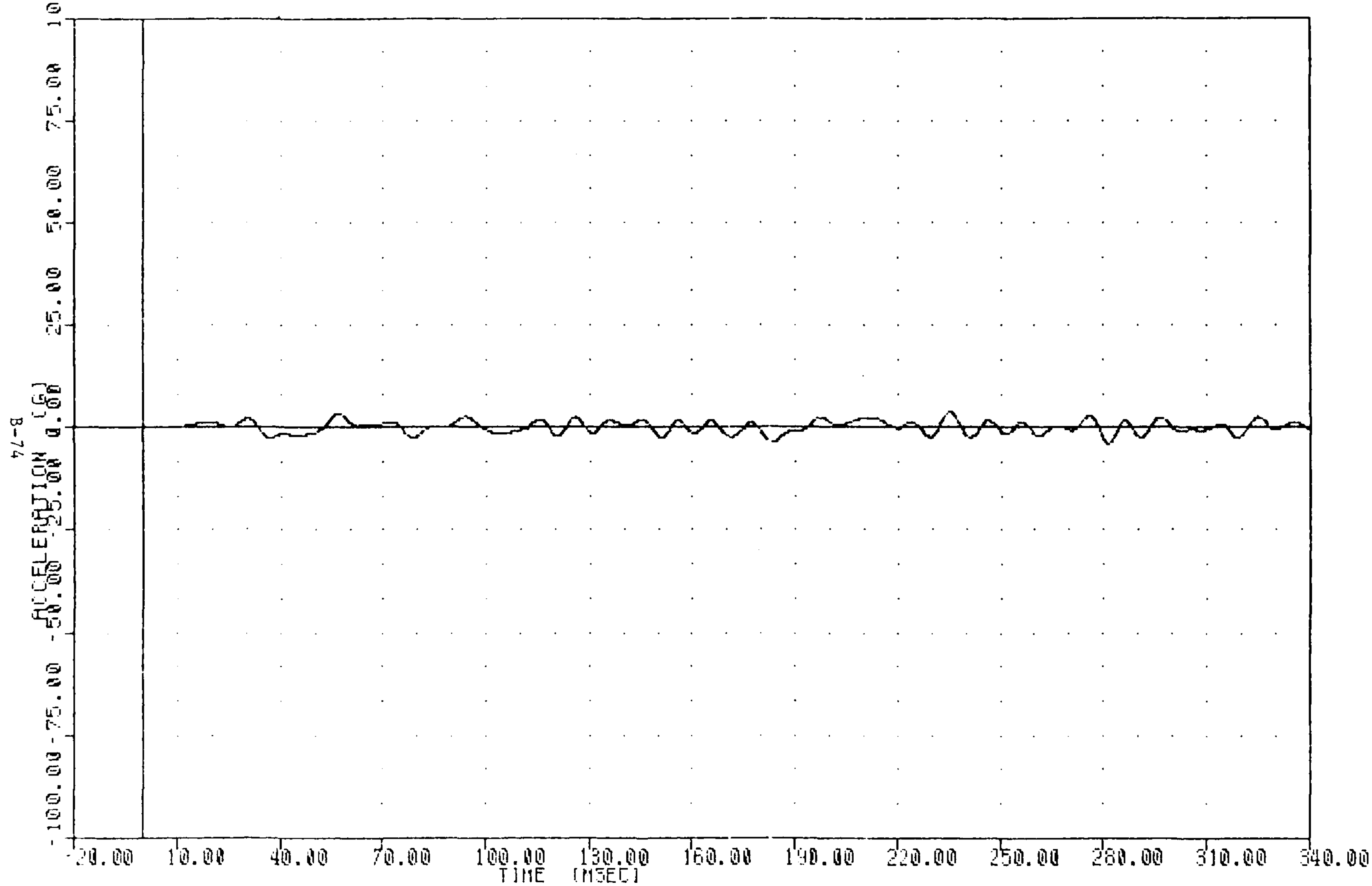
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -1.00 @ 297.38 , 0.75 @ 261.38



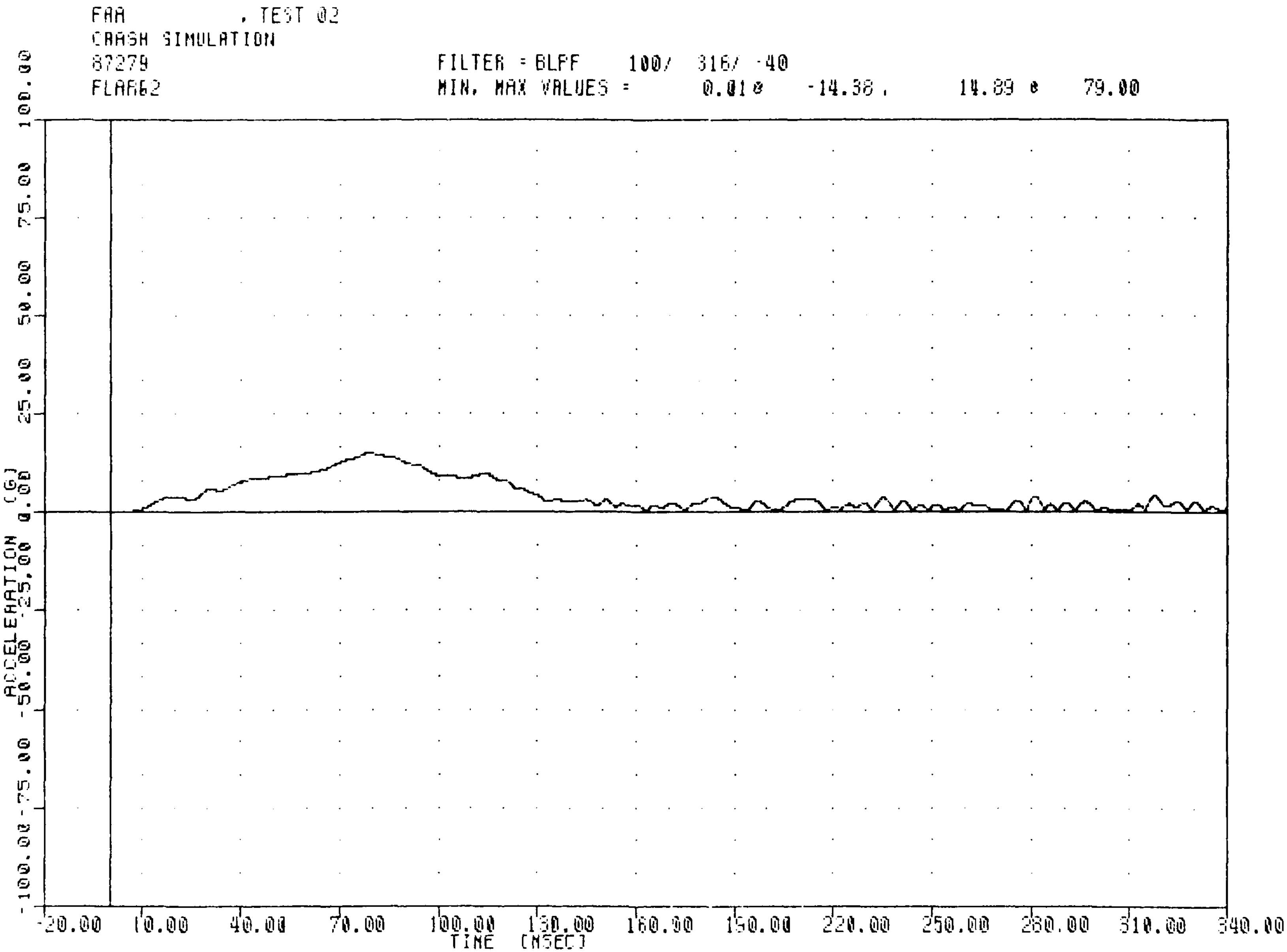
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD INBOARD SEAT TRACK LATERAL ACCELERATION - AFT

FAA , TEST 02
CRASH SIMULATION
87279
FLAZ62

FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -3.92 @ 281.38 , 3.73 @ 235.38



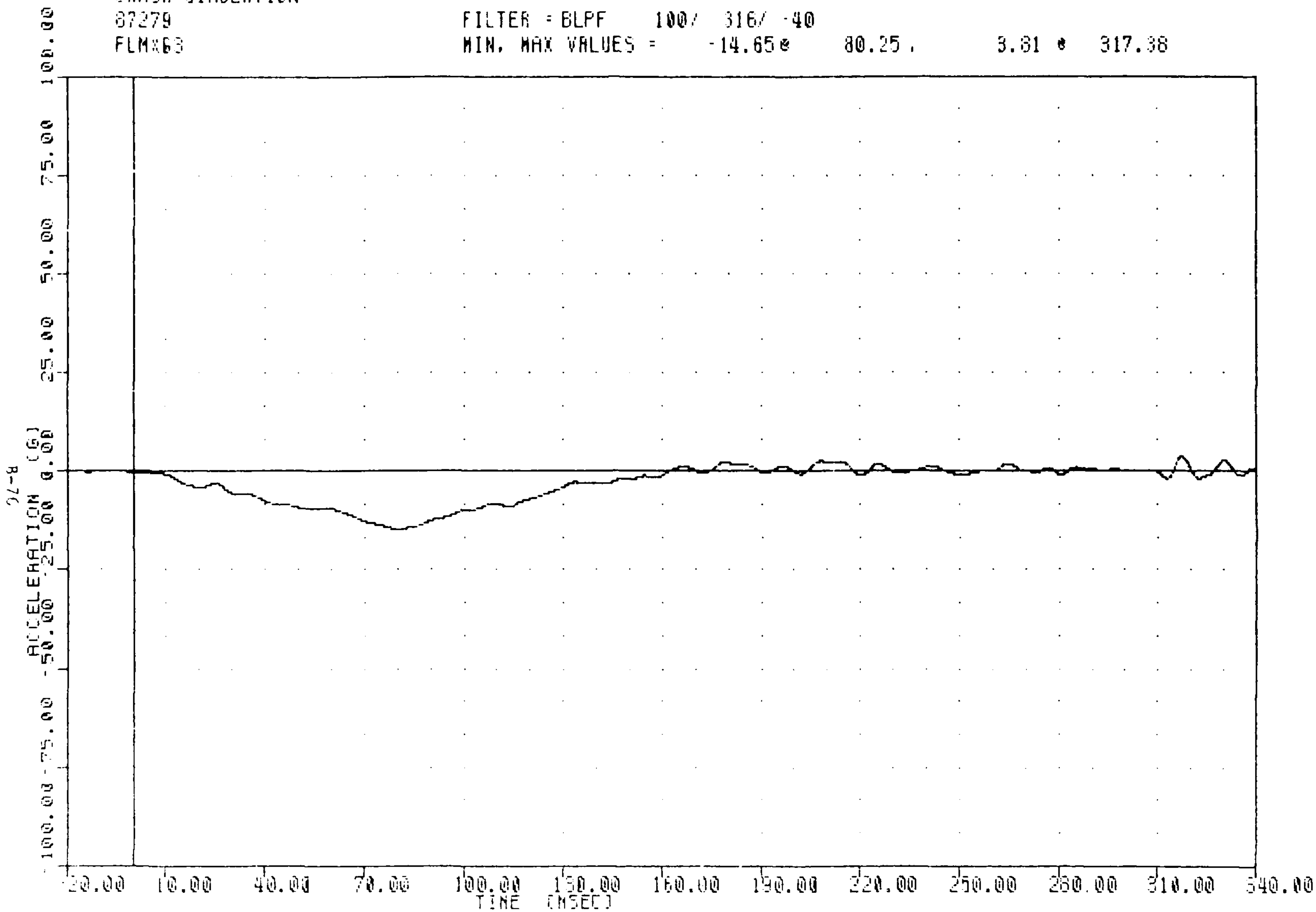
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD INBOARD SEAT TRACK VERTICAL ACCELERATION - AFT



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD INBOARD SEAT TRACK ACCELERATION - AFT RESULTANT

FAA , TEST 02
CRASH SIMULATION
87279
FLM#63

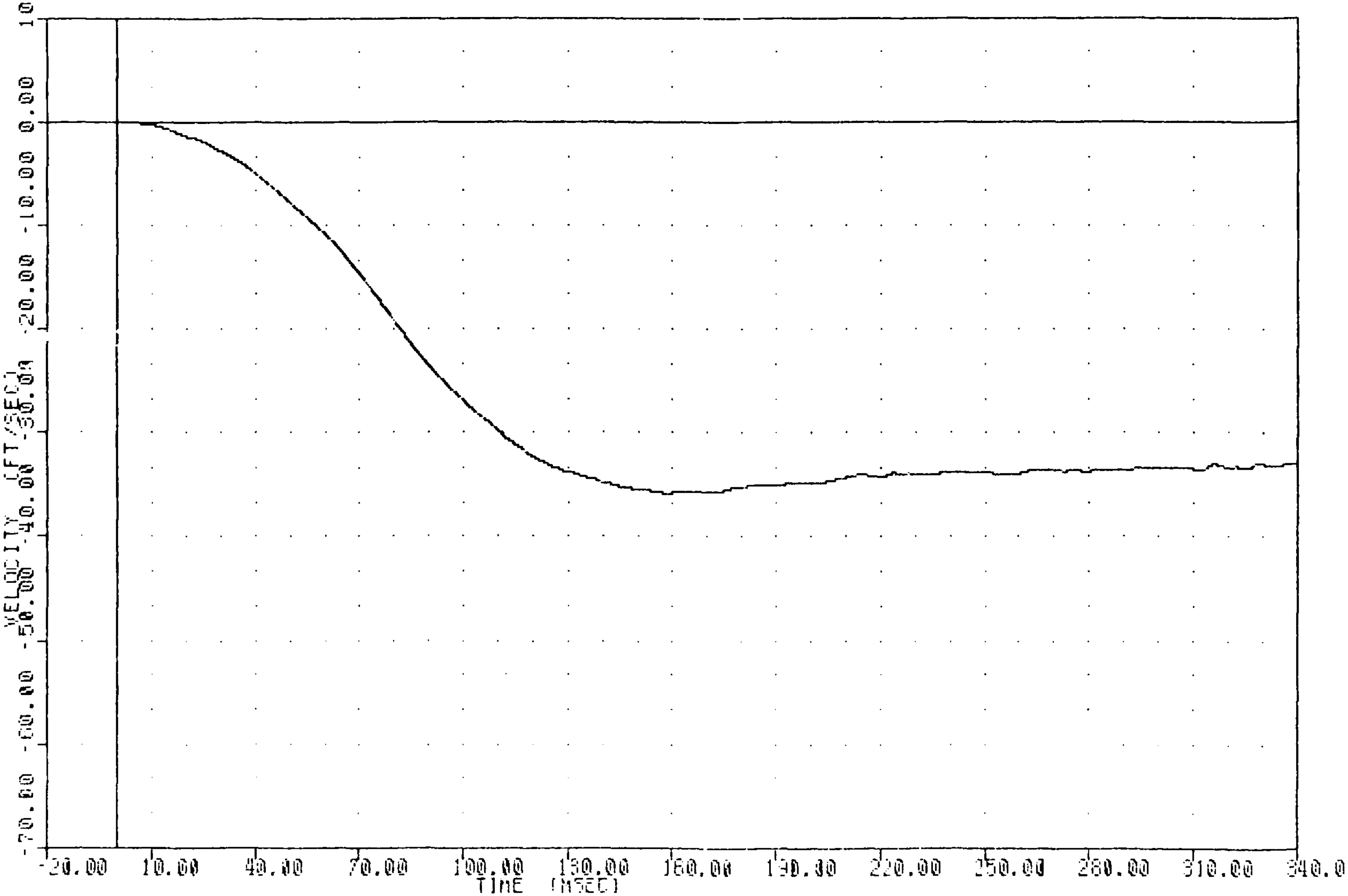
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -14.65 @ 80.25 , 3.81 @ 317.38



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD INBOARD SEAT TRACK LONGITUDINAL ACCELERATION - MID

FAA , TEST 02
CRASH SIMULATION
87279
FLMXV3

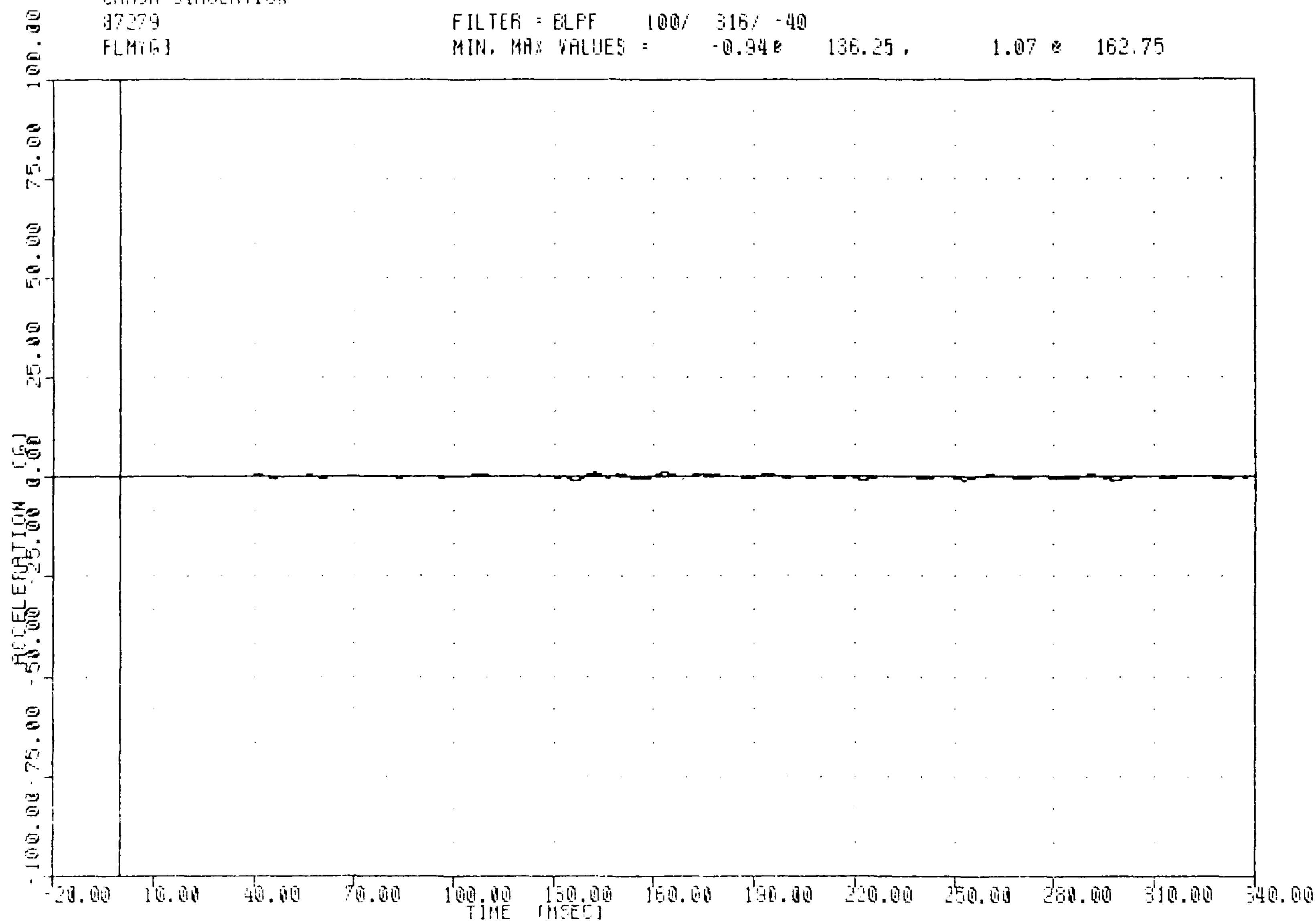
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -35.81 @ 158.13 , 0.00 @ -20.00



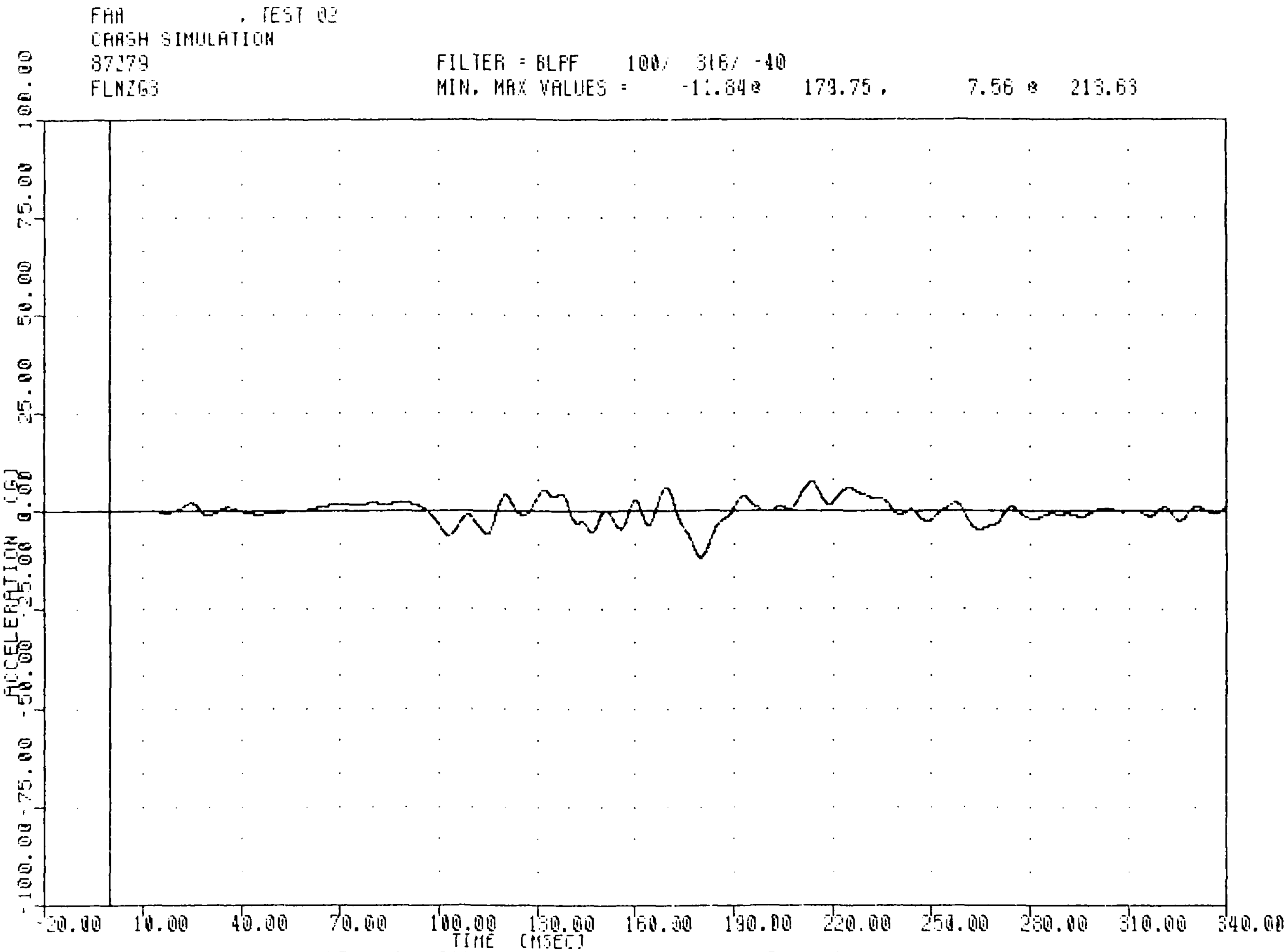
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD INBOARD SEAT TAPE LONGITUDINAL VELOCITY - MID

FAA , TEST 02
CRASH SIMULATION
87279
FLMY(G)

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.94 @ 136.25 , 1.07 @ 162.75



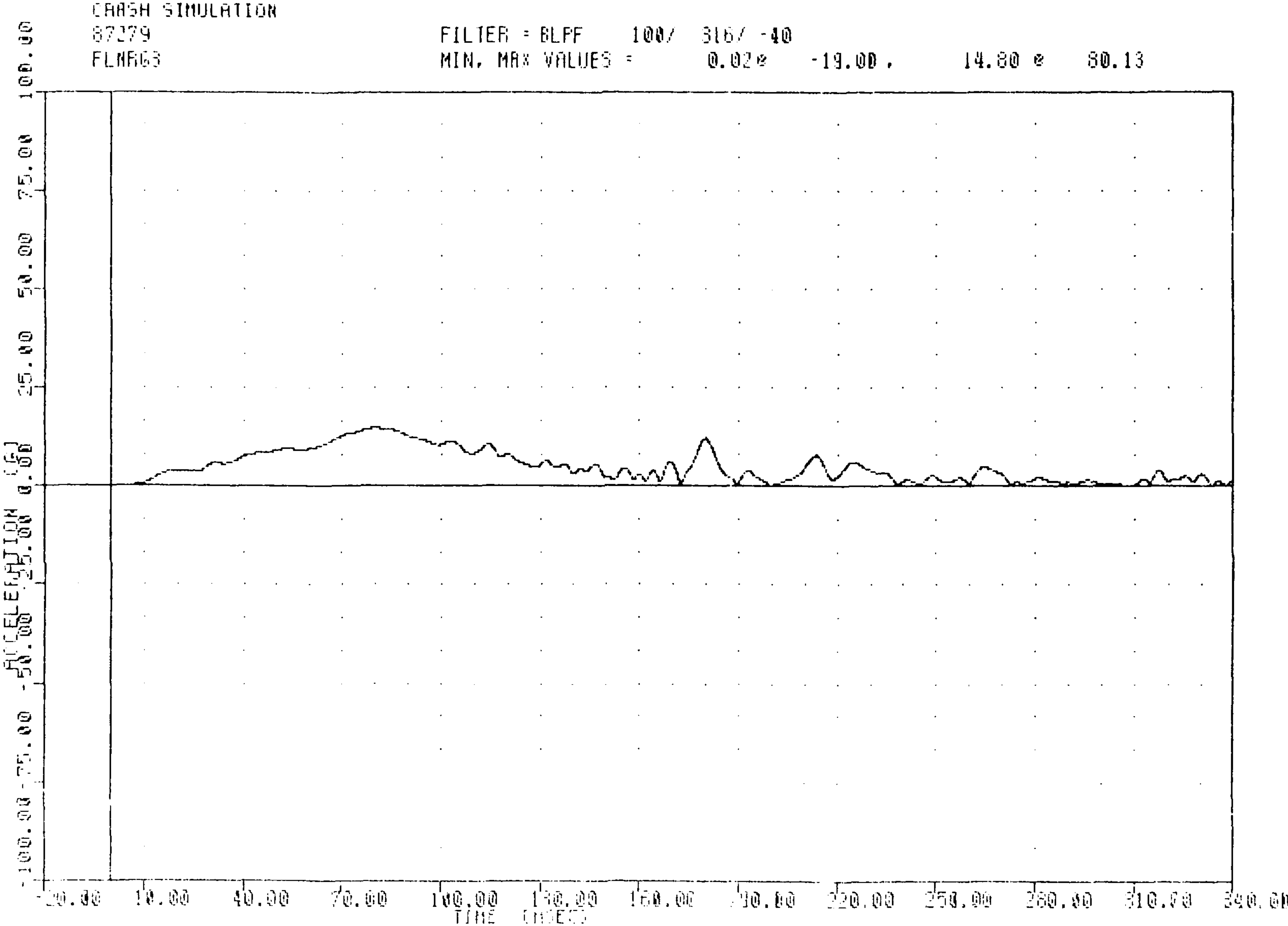
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD INBOARD SEAT TRACK LATERAL ACCELERATION - MID



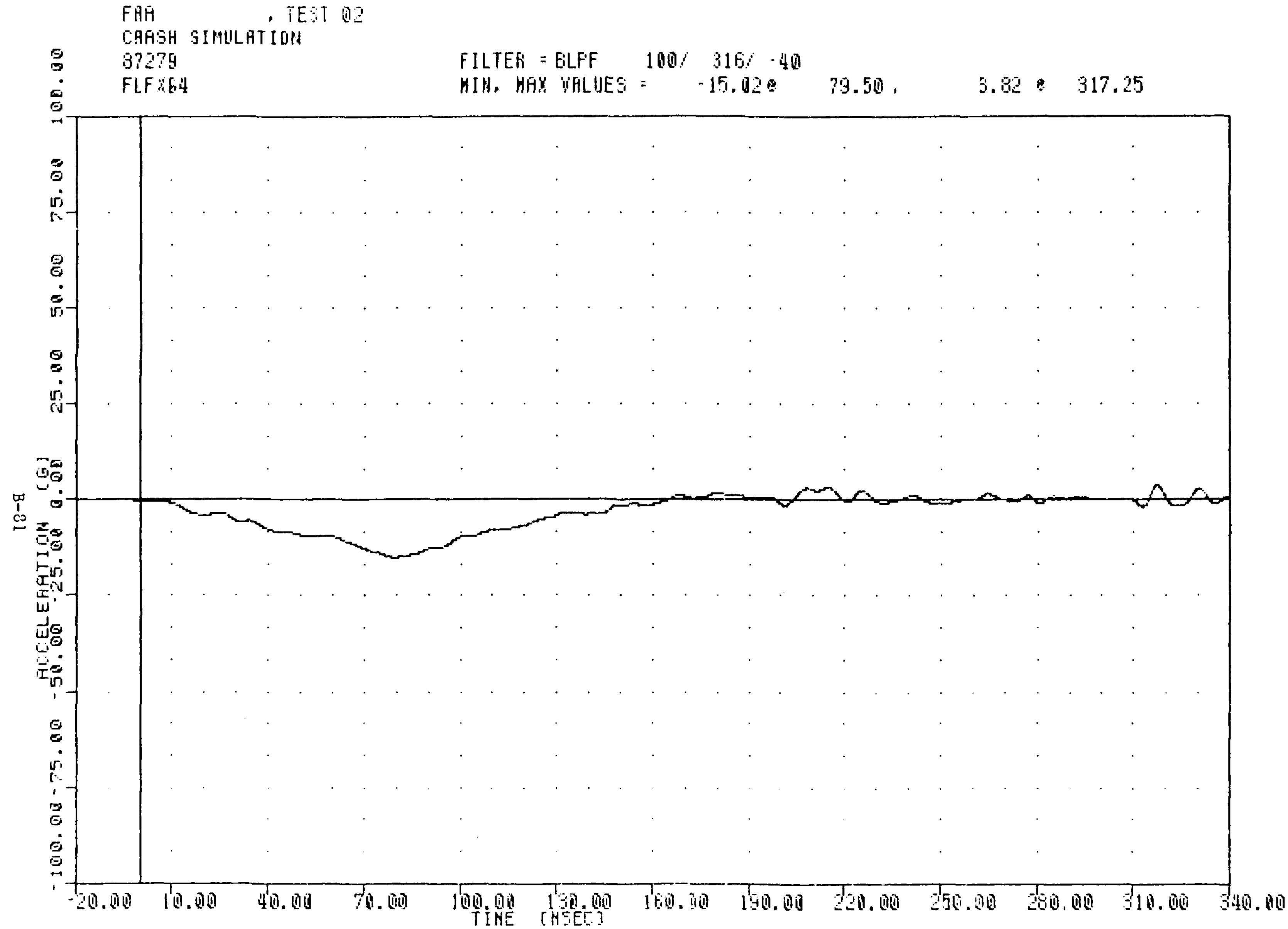
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD INBOARD SEAT TRACK VERTICAL ACCELERATION - MID

FAA . TEST 62
CRASH SIMULATION
87279
FLNRG3

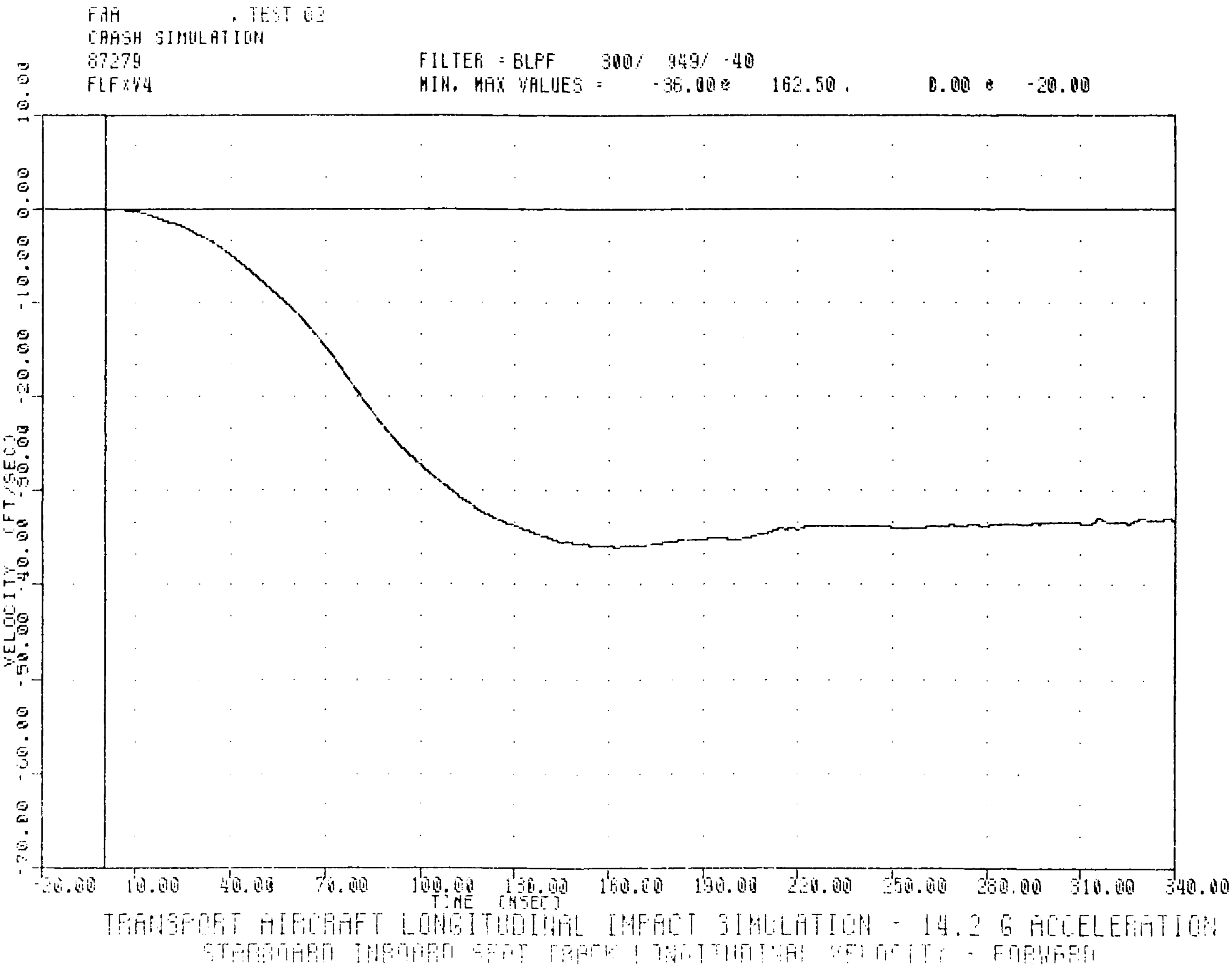
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = 0.02@ -19.00 , 14.80 @ 80.13



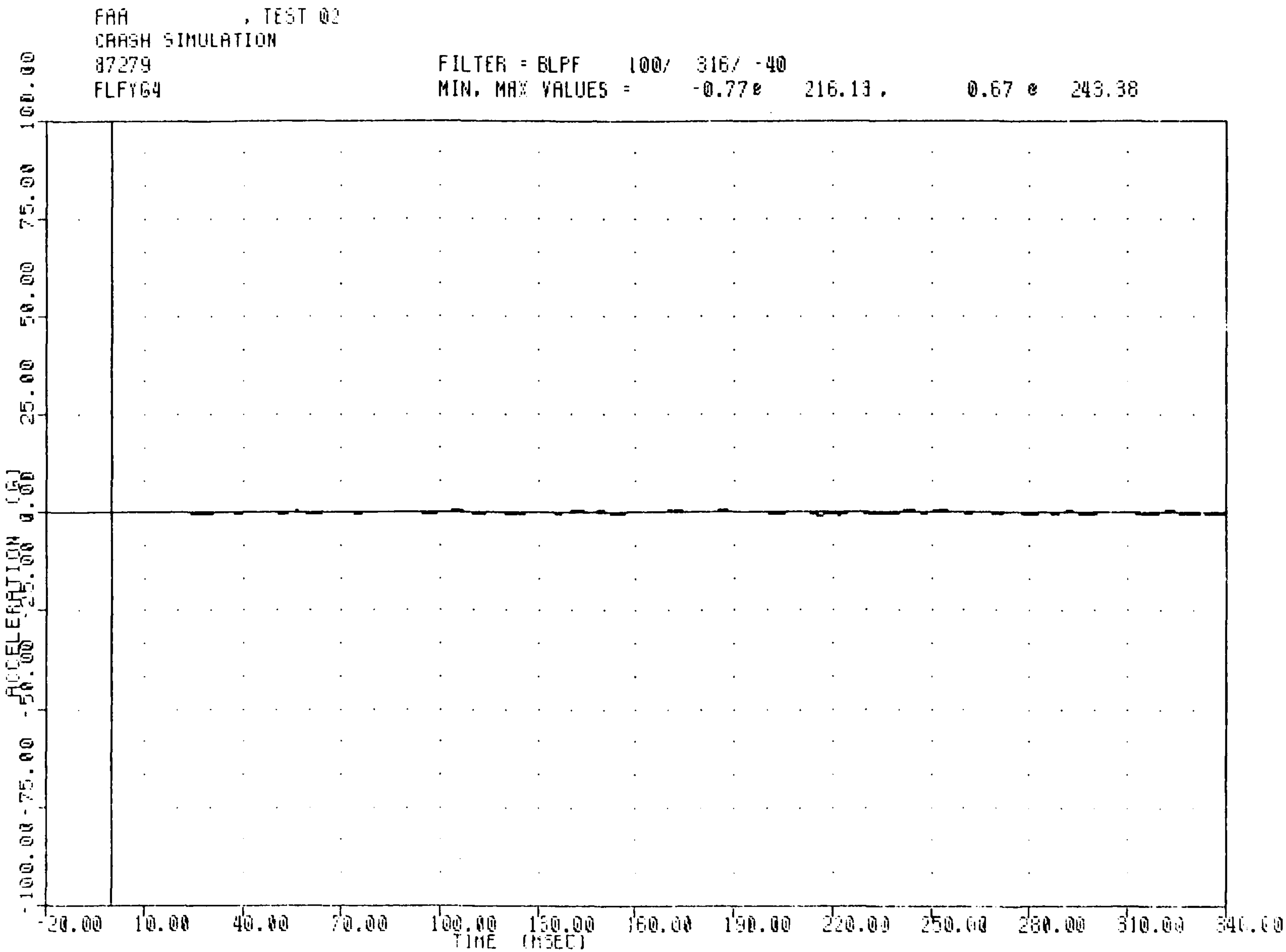
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION



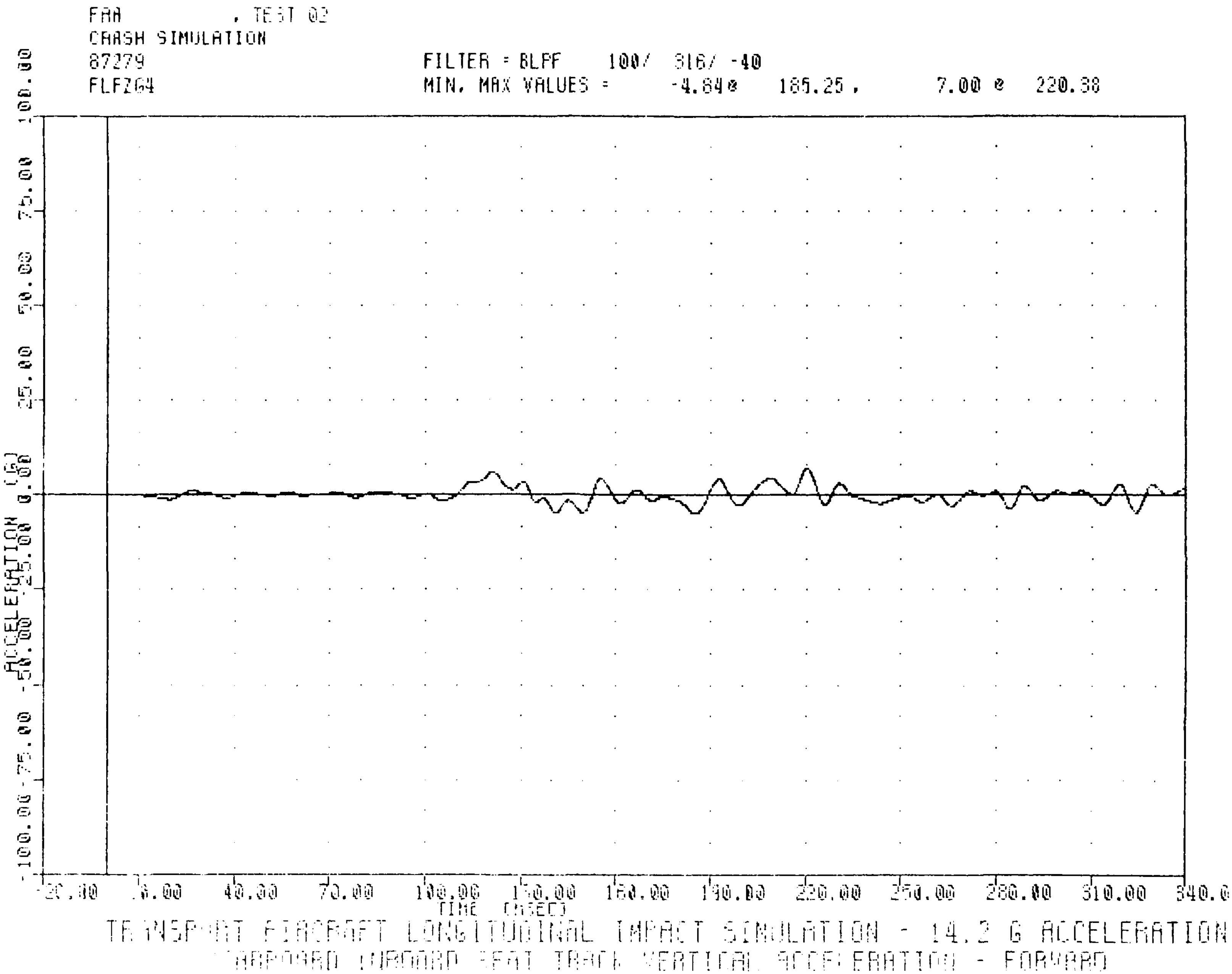
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD INBOARD SEAT TRACK LONGITUDINAL ACCELERATION - FORWARD



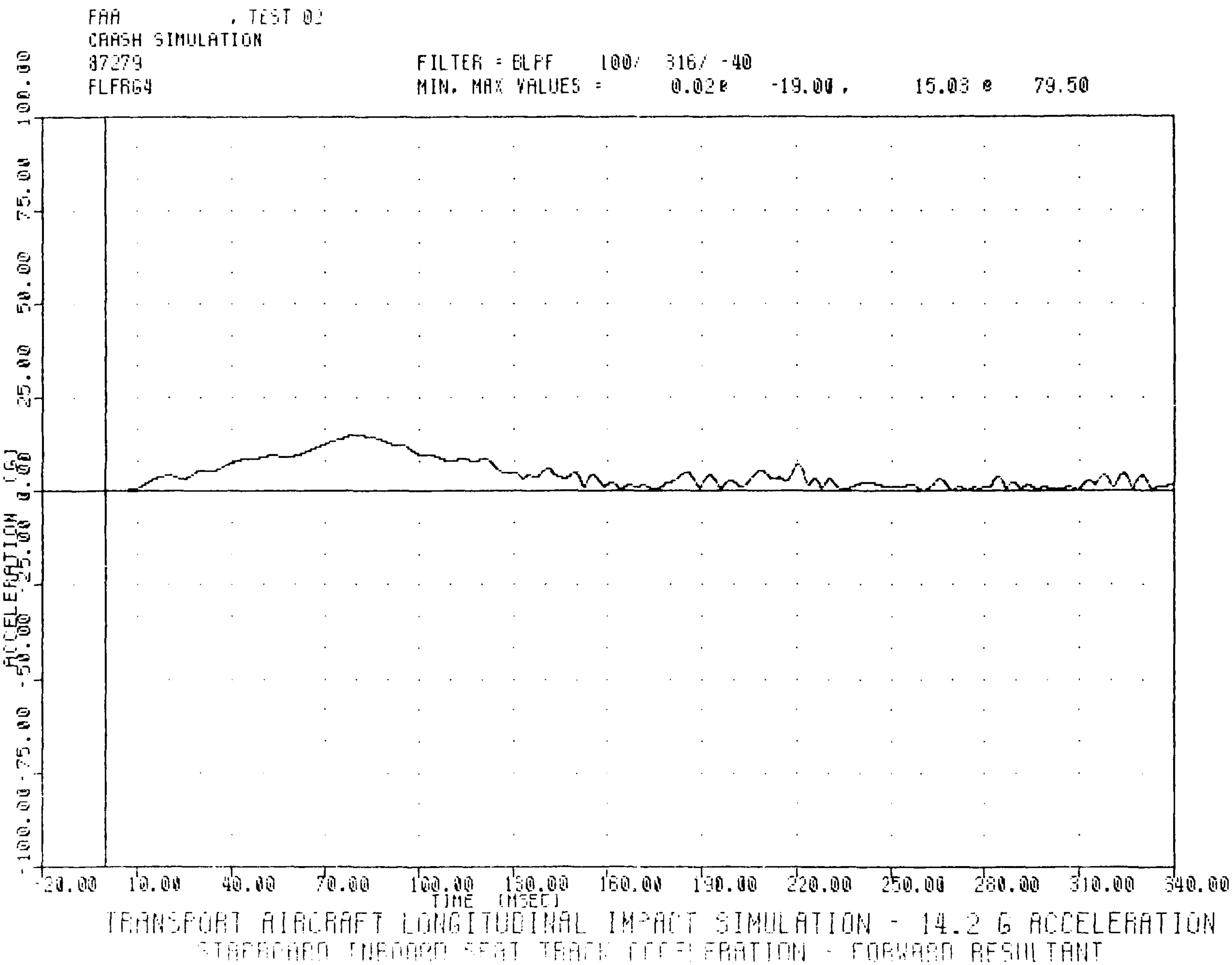
FAA , TEST 02
CRASH SIMULATION
87279
FLFXV4
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -36.00 @ 162.50 , 0.00 @ -20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
VELOCITY (FT/SEC)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD INBOARD SEAT TRACK LATERAL ACCELERATION - FORWARD

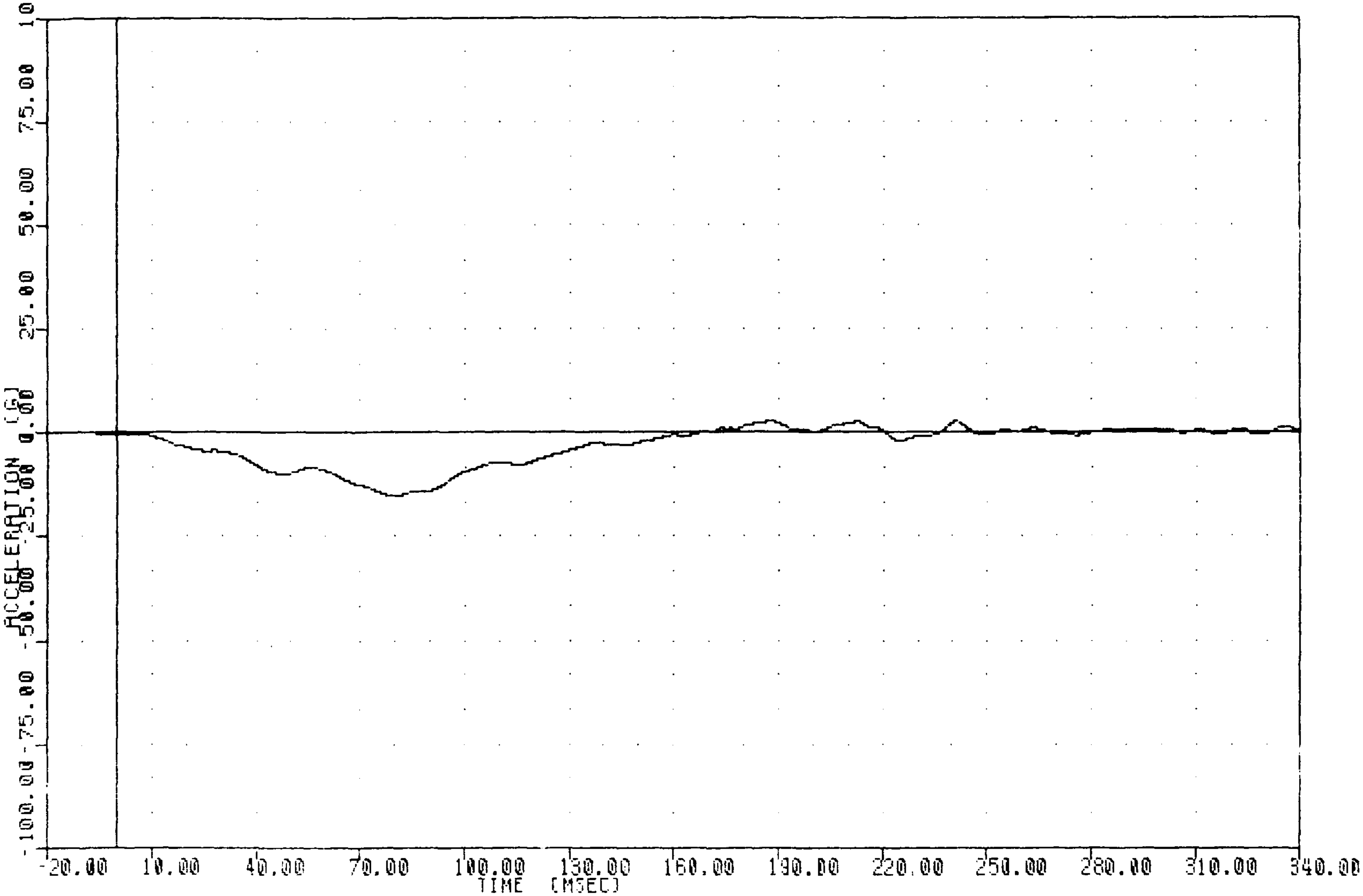


FAA , TEST 02
CRASH SIMULATION
87279
FLFZ64
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -4.84 @ 185.25 , 7.00 @ 220.38
ACCELERATION (G)
100.00
75.00
50.00
25.00
0.00
-25.00
-50.00
-75.00
-100.00
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD INBOARD SEAT TRACK VERTICAL ACCELERATION - FORWARD

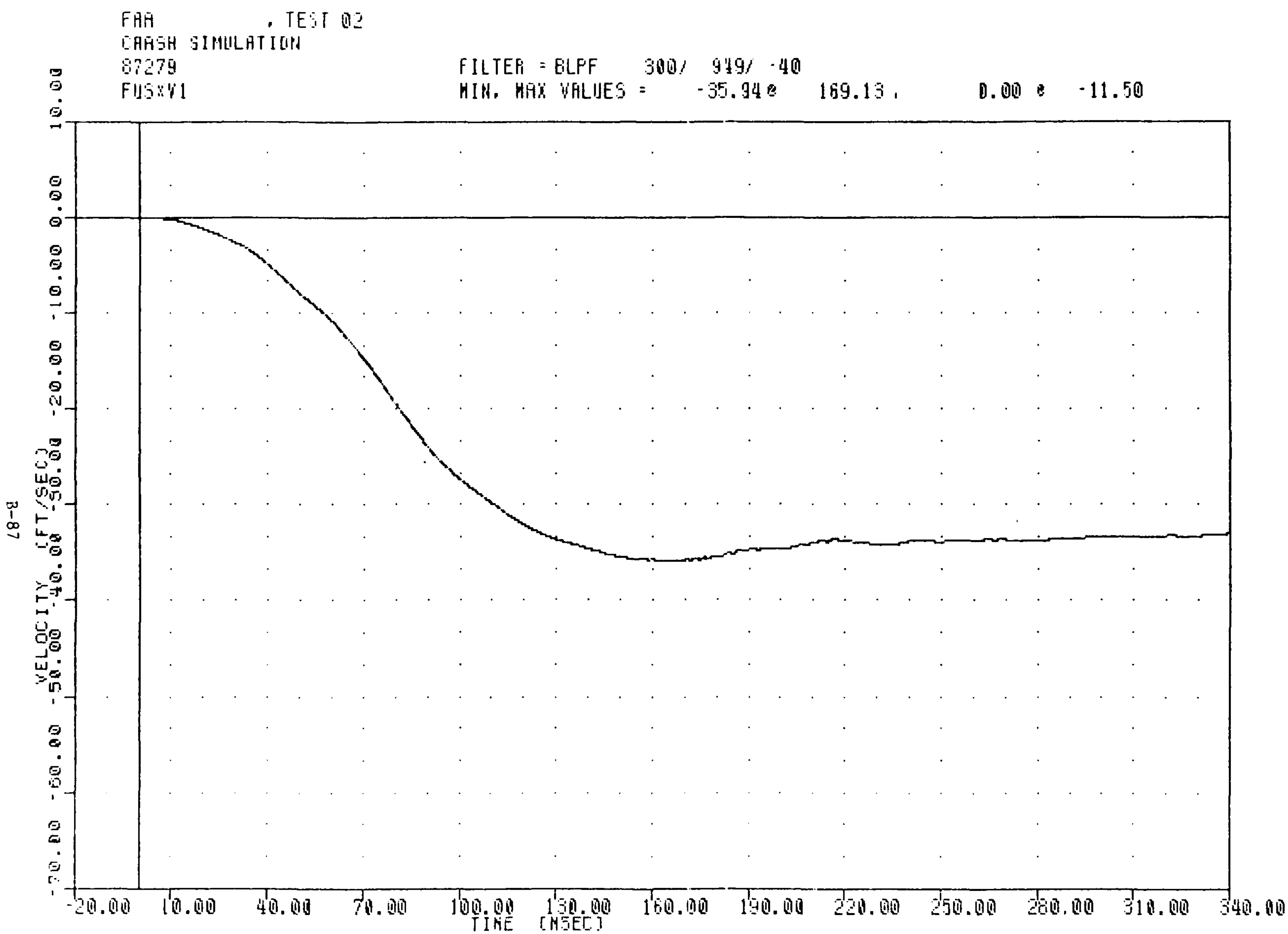

FAA , TEST 02
CRASH SIMULATION
87279
FLFRG4
FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = 0.02 @ -19.00 , 15.03 @ 79.50
100.00
75.00
50.00
25.00
0.00
-25.00
-50.00
-75.00
-100.00
ACCELERATION (G)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD INBOARD SEAT TRACK ACCELERATION - FORWARD RESULTANT

FAA , TEST 02
CRASH SIMULATION
87279
FUSXG1

FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -15.21@ 79.63 , 2.77 @ 187.63



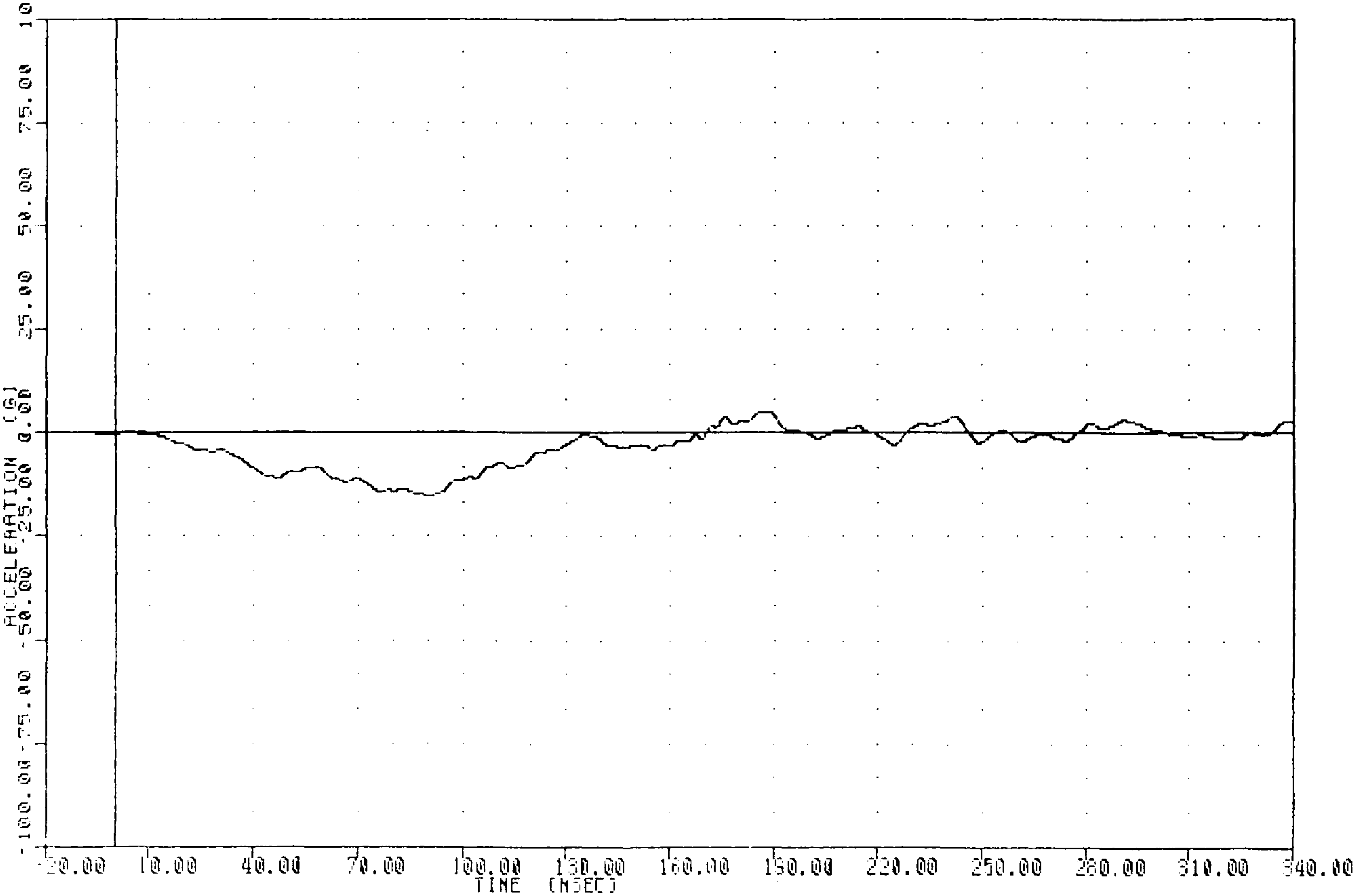
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
PORT FUSELAGE LONGITUDINAL ACCELERATION



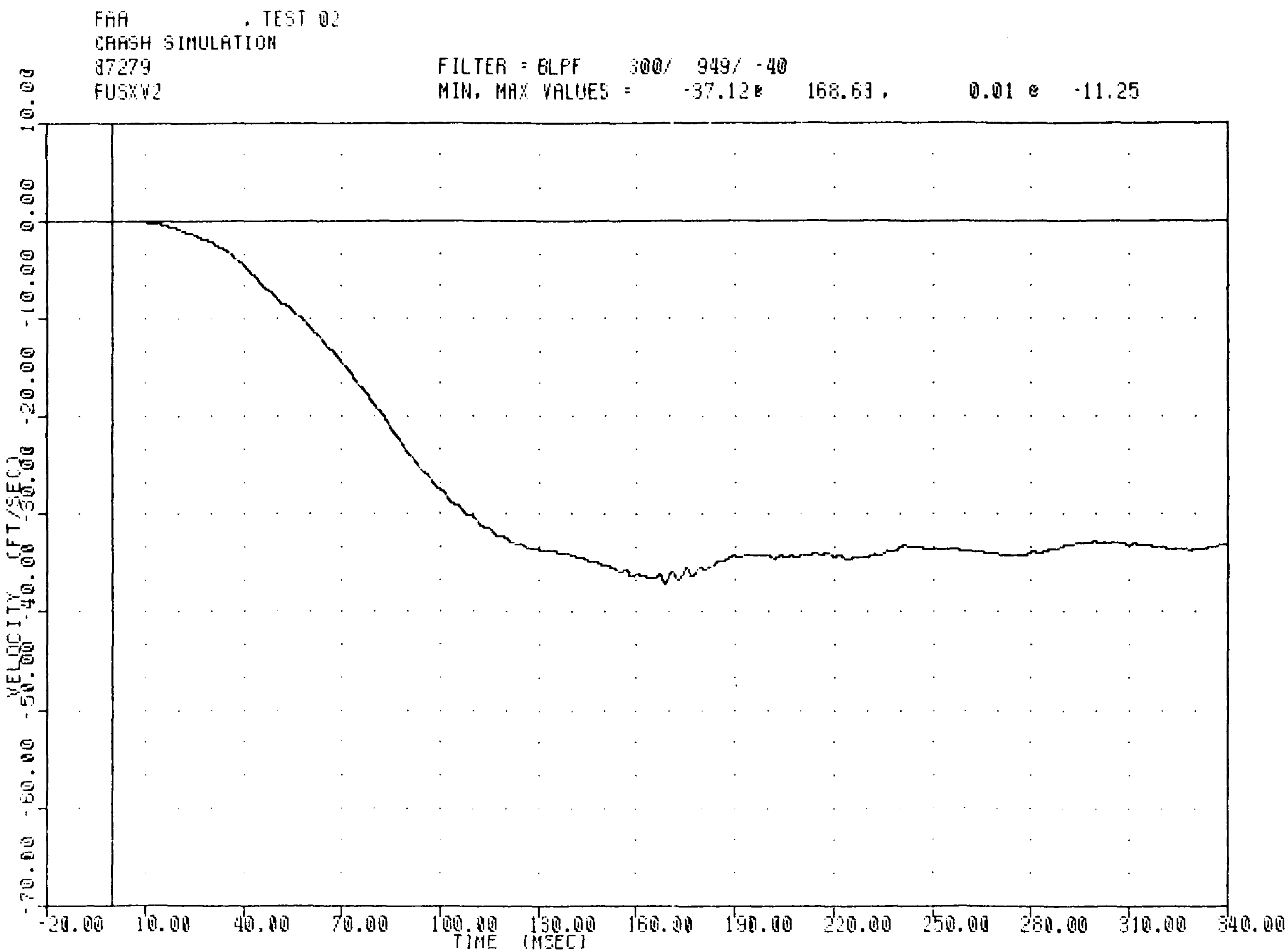
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
PORT FUSELAGE LONGITUDINAL VELOCITY

FAA , TEST 02
CRASH SIMULATION
87279
FUSX62

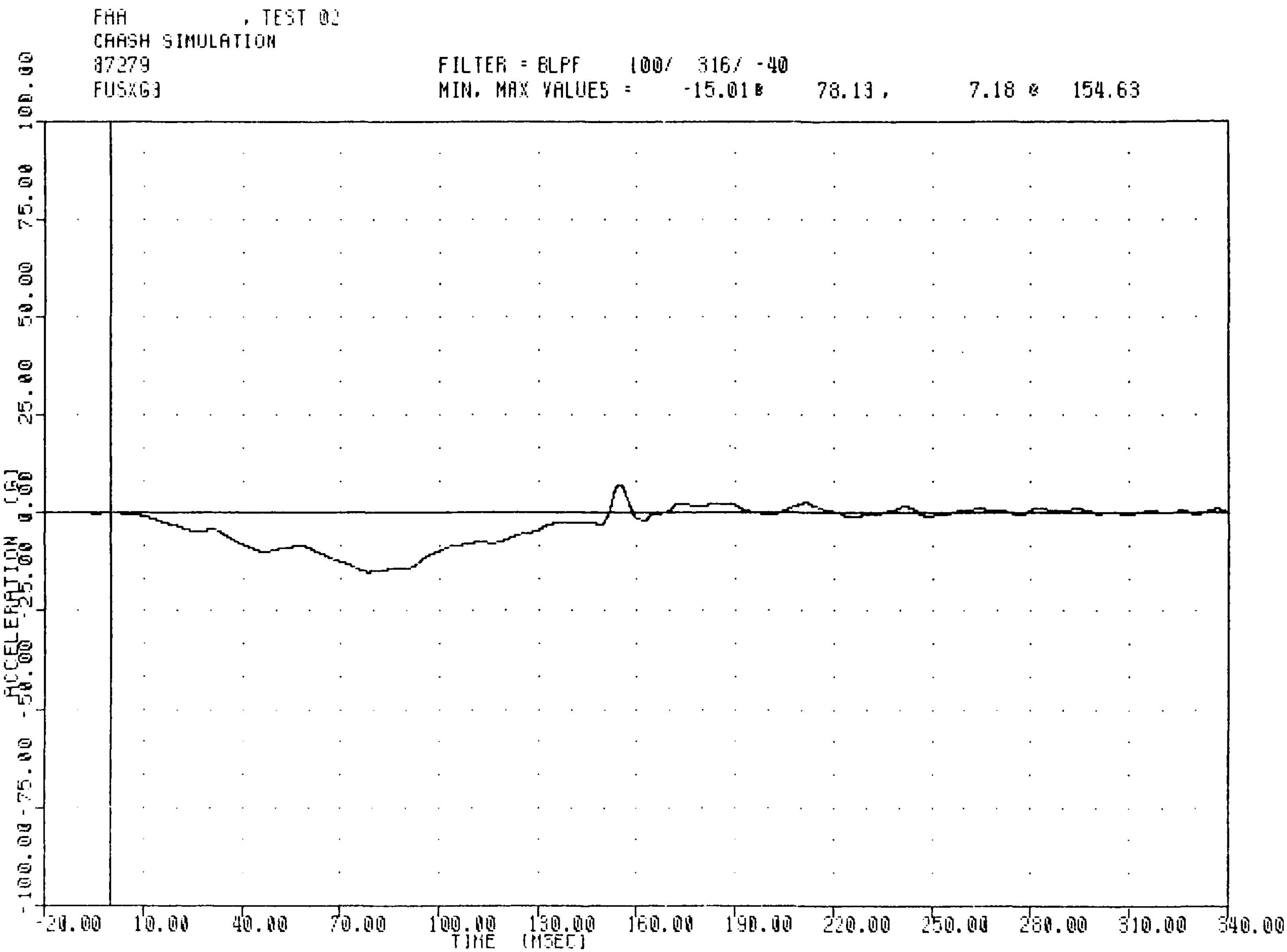
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -15.39 @ 90.50 , 5.16 @ 186.63



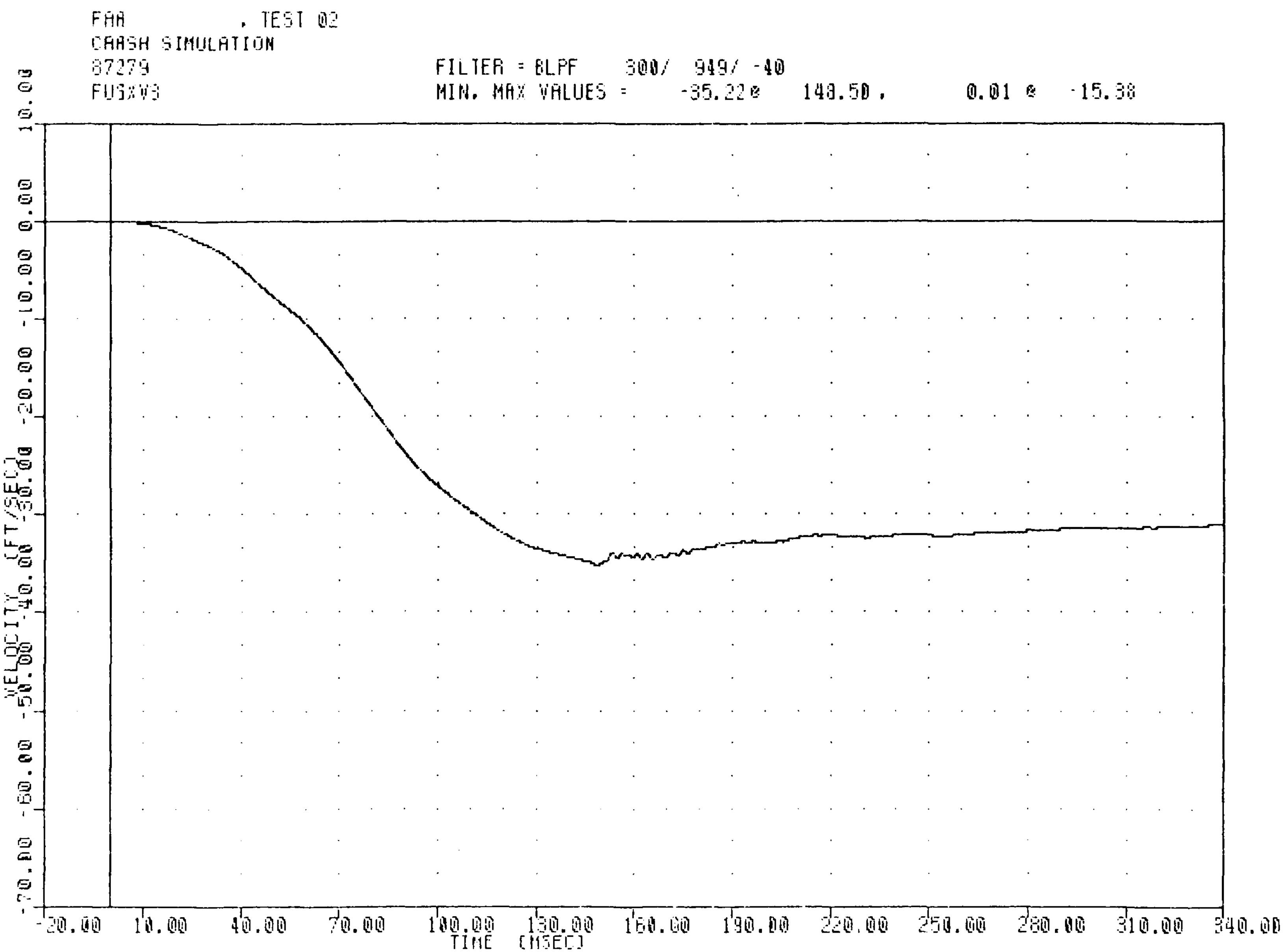
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
TOP FUSELAGE LONGITUDINAL ACCELERATION



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
TOP FUSELAGE LONGITUDINAL VELOCITY

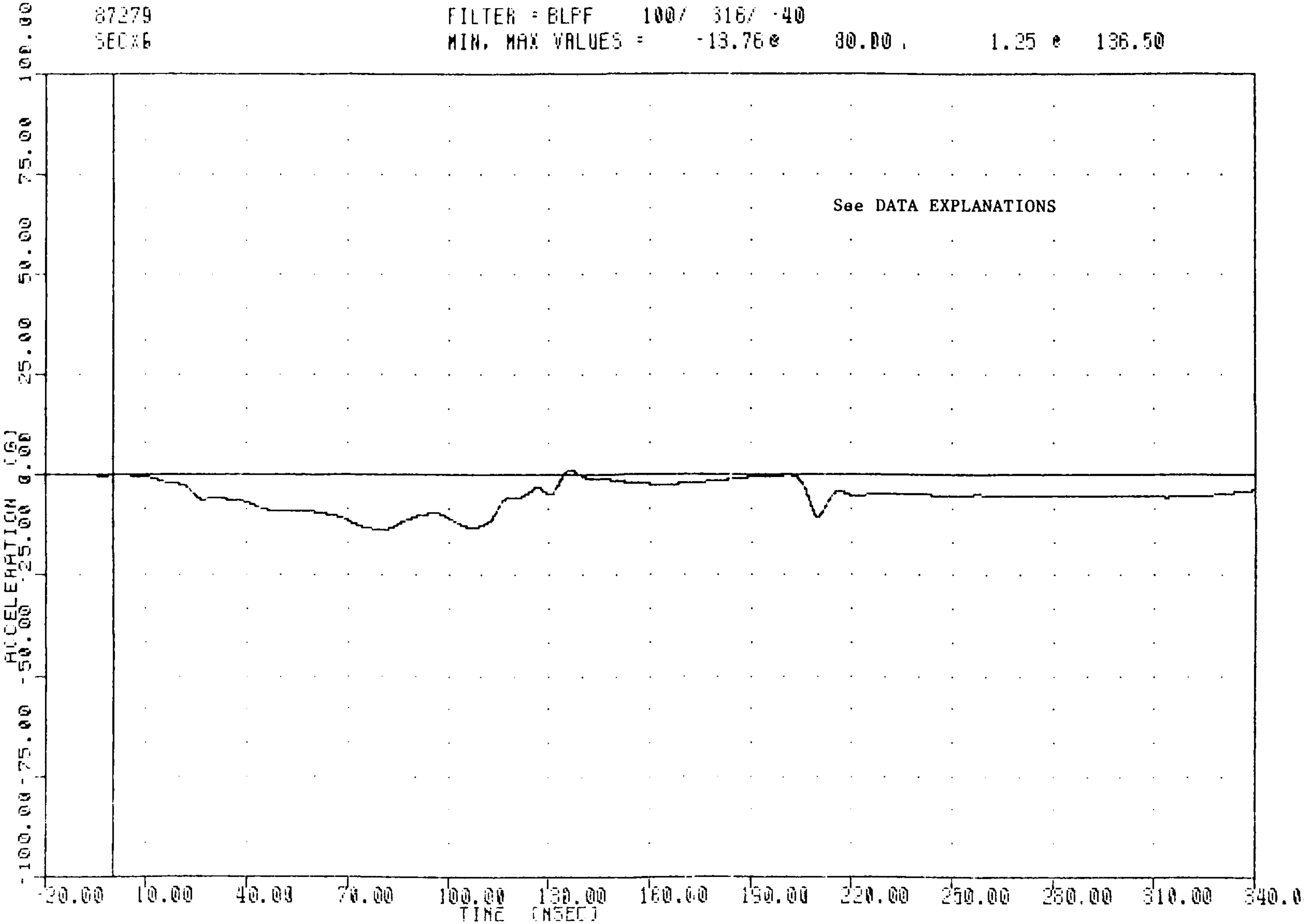


TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD FUSELAGE LONGITUDINAL ACCELERATION



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD FUSELAGE LONGITUDINAL VELOCITY

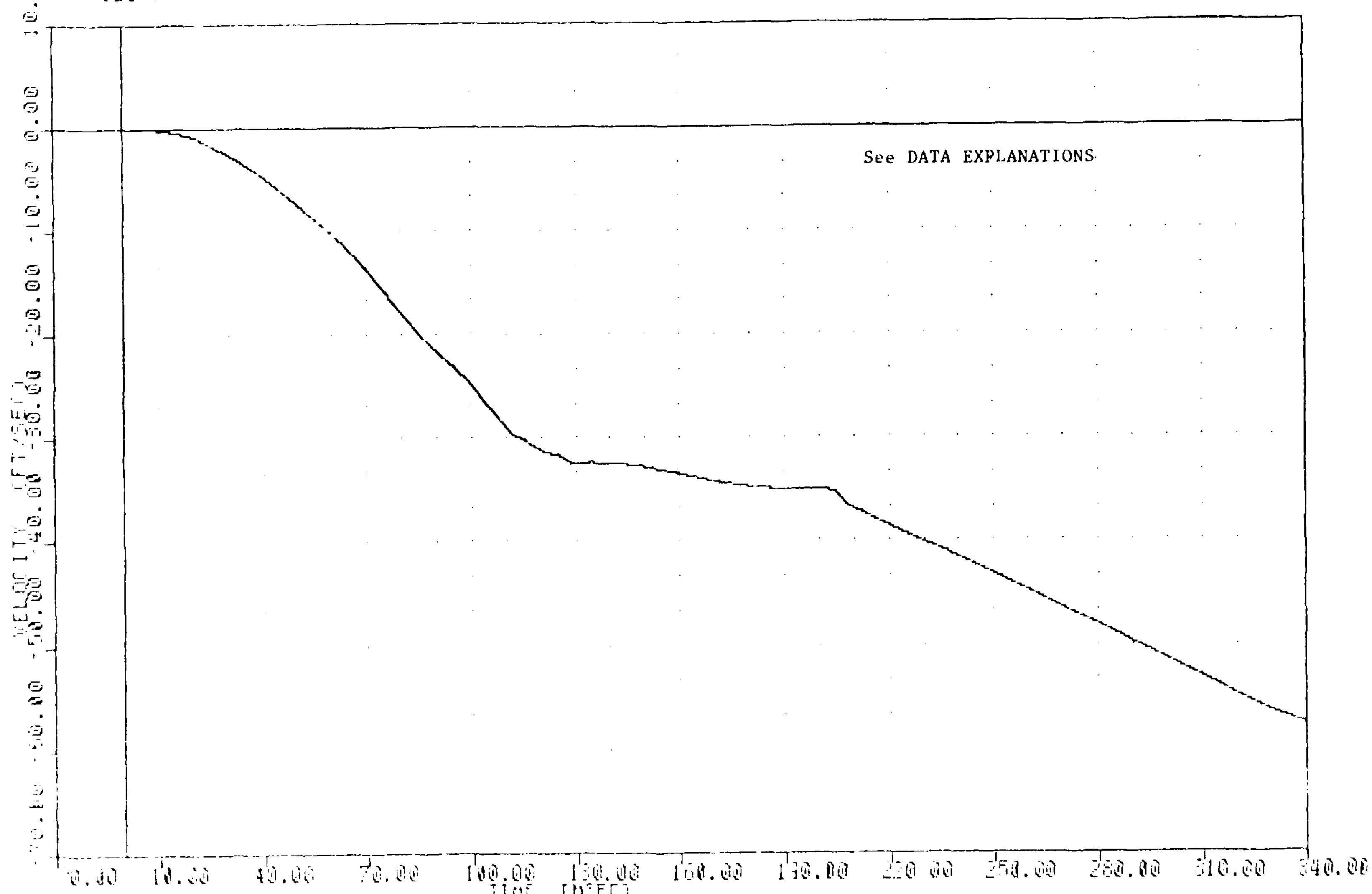
FAA , TEST 02
CRASH SIMULATION
87279 FILTER = BLFF 100/ 316/ -40
SECX6 MIN, MAX VALUES = -13.76 @ 80.00 , 1.25 @ 136.50



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT C LONGITUDINAL ACCELERATION

FAA , TEST 02
CRASH SIMULATION
87279
SEC×0

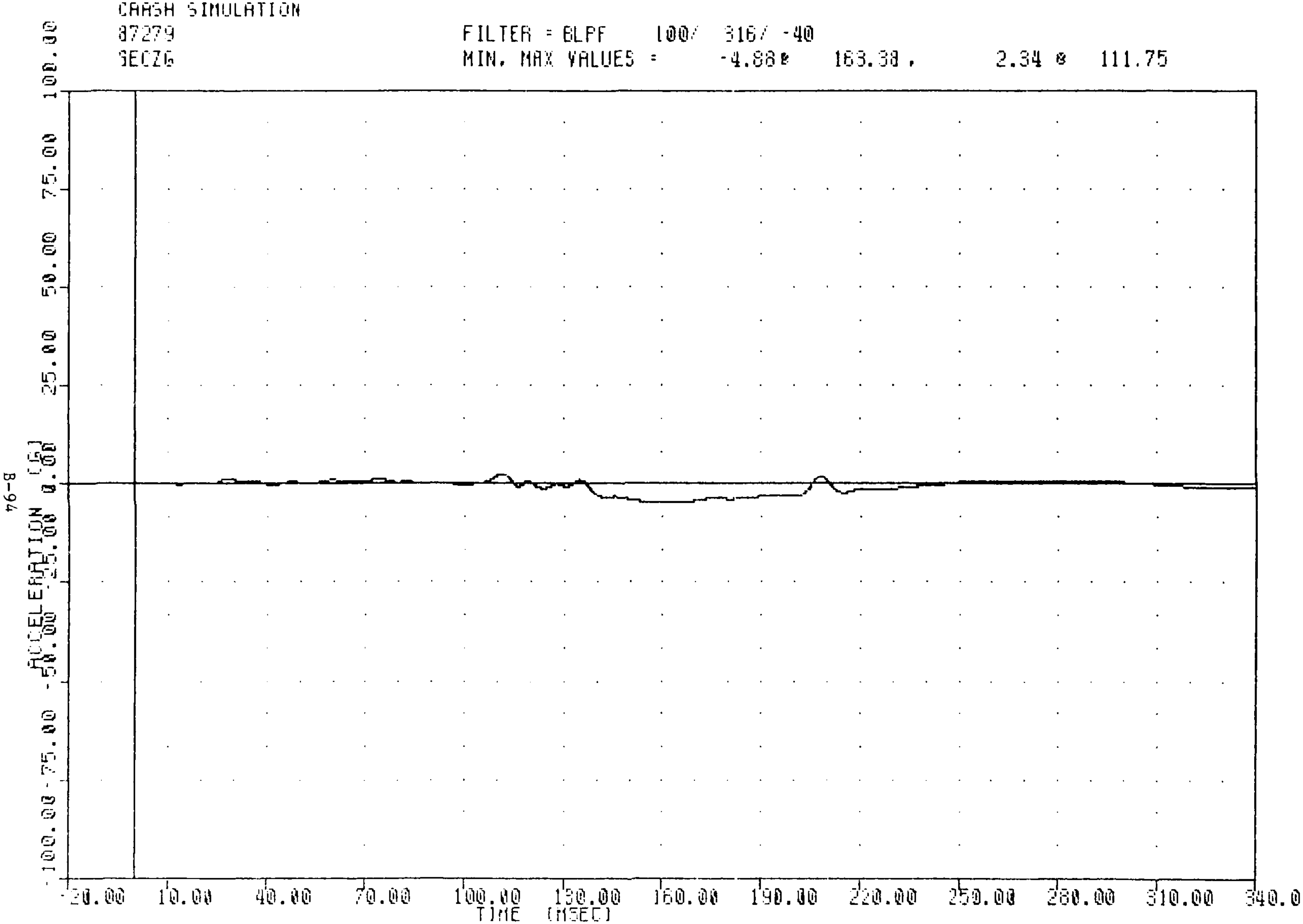
FILTER = BLPF 300/ 949/ -40
MIN. MAX VALUES = -57.73@ 340.00 . 0.00 @ -12.75



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION

FAA , TEST 03
CRASH SIMULATION
87279
SECZG

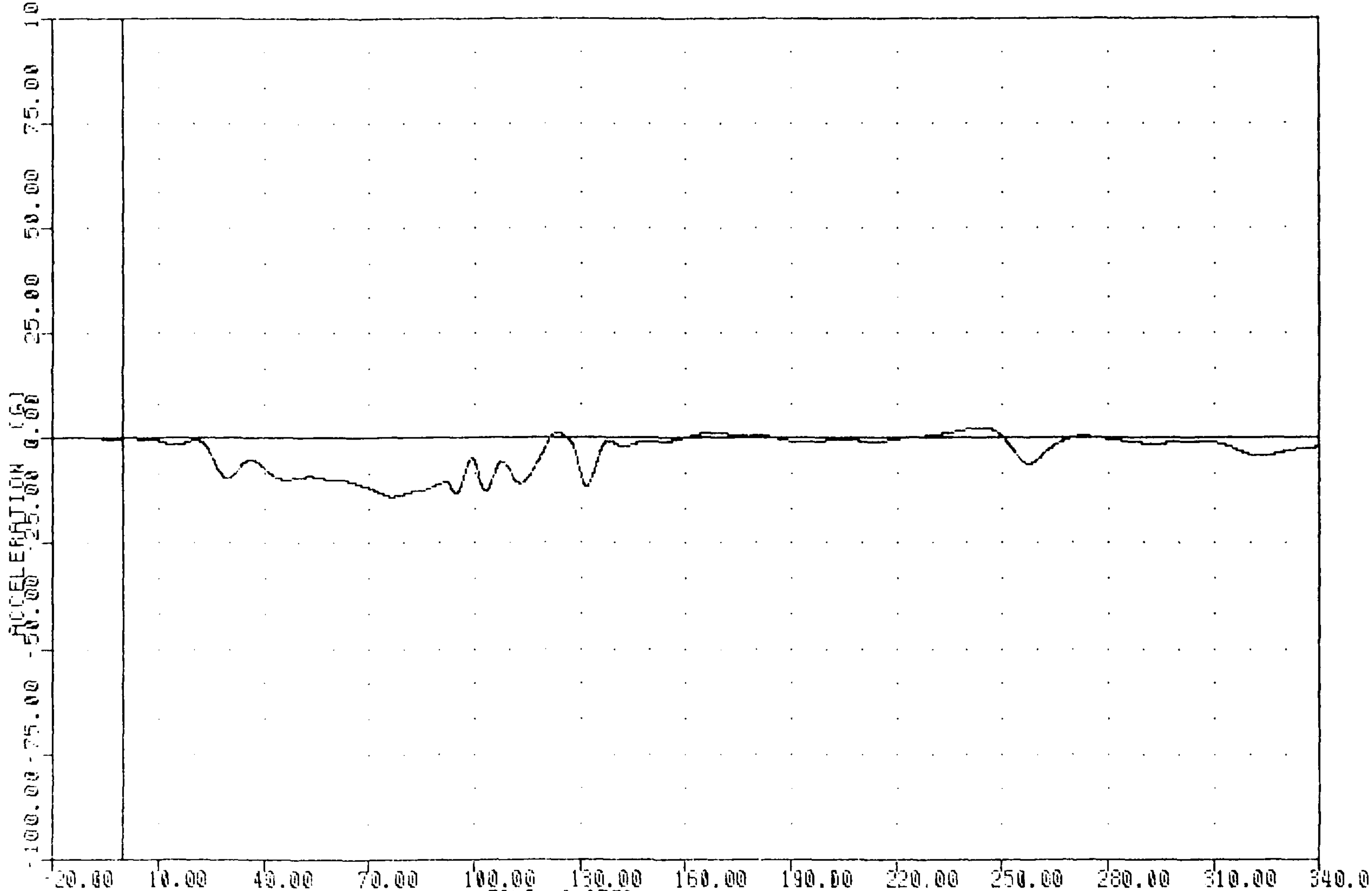
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -4.88 @ 163.38 , 2.34 @ 111.75



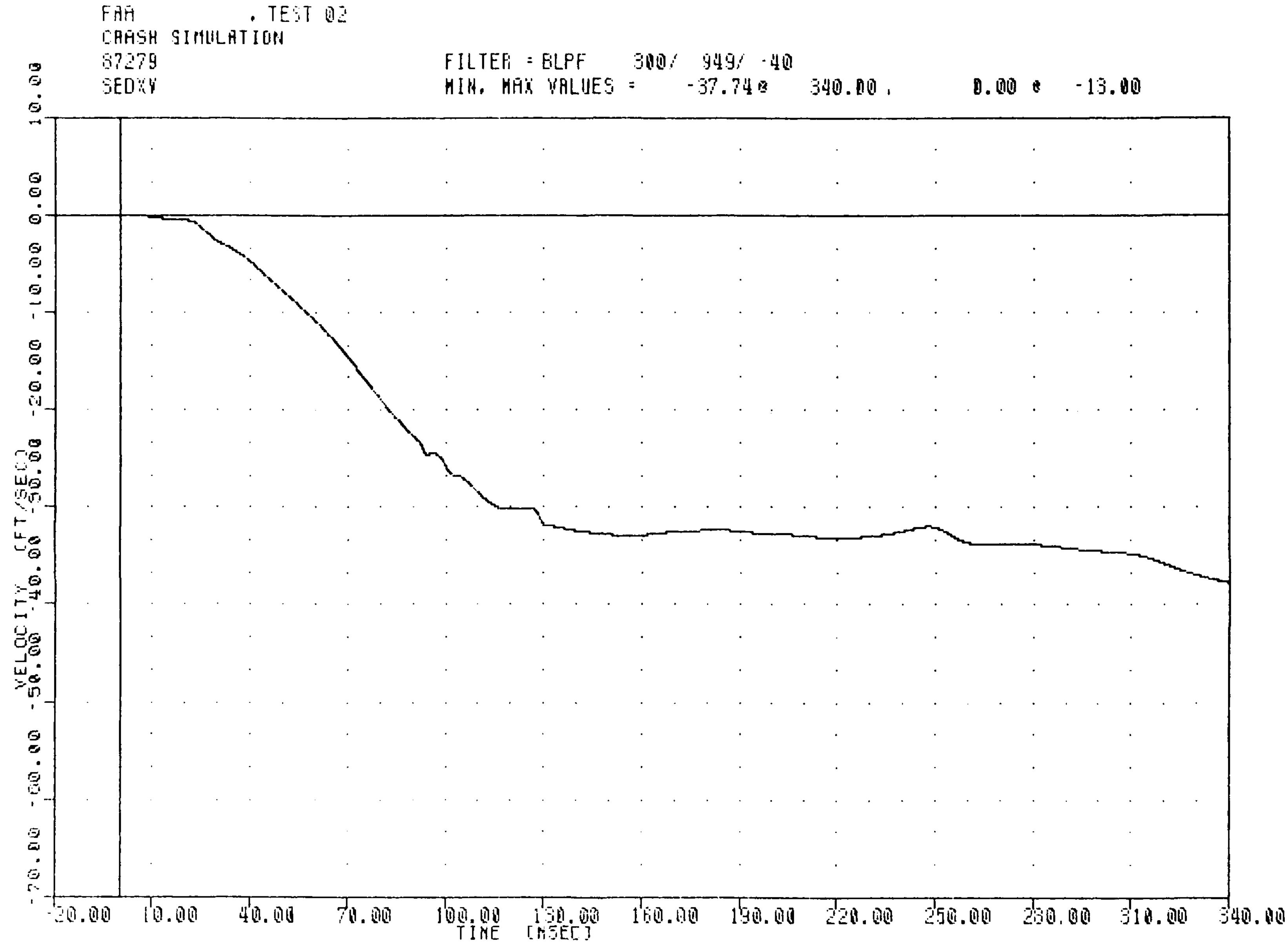
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT F VERTICAL ACCELERATION

FAA , TEST 02
CRASH SIMULATION
87279
SEDXG

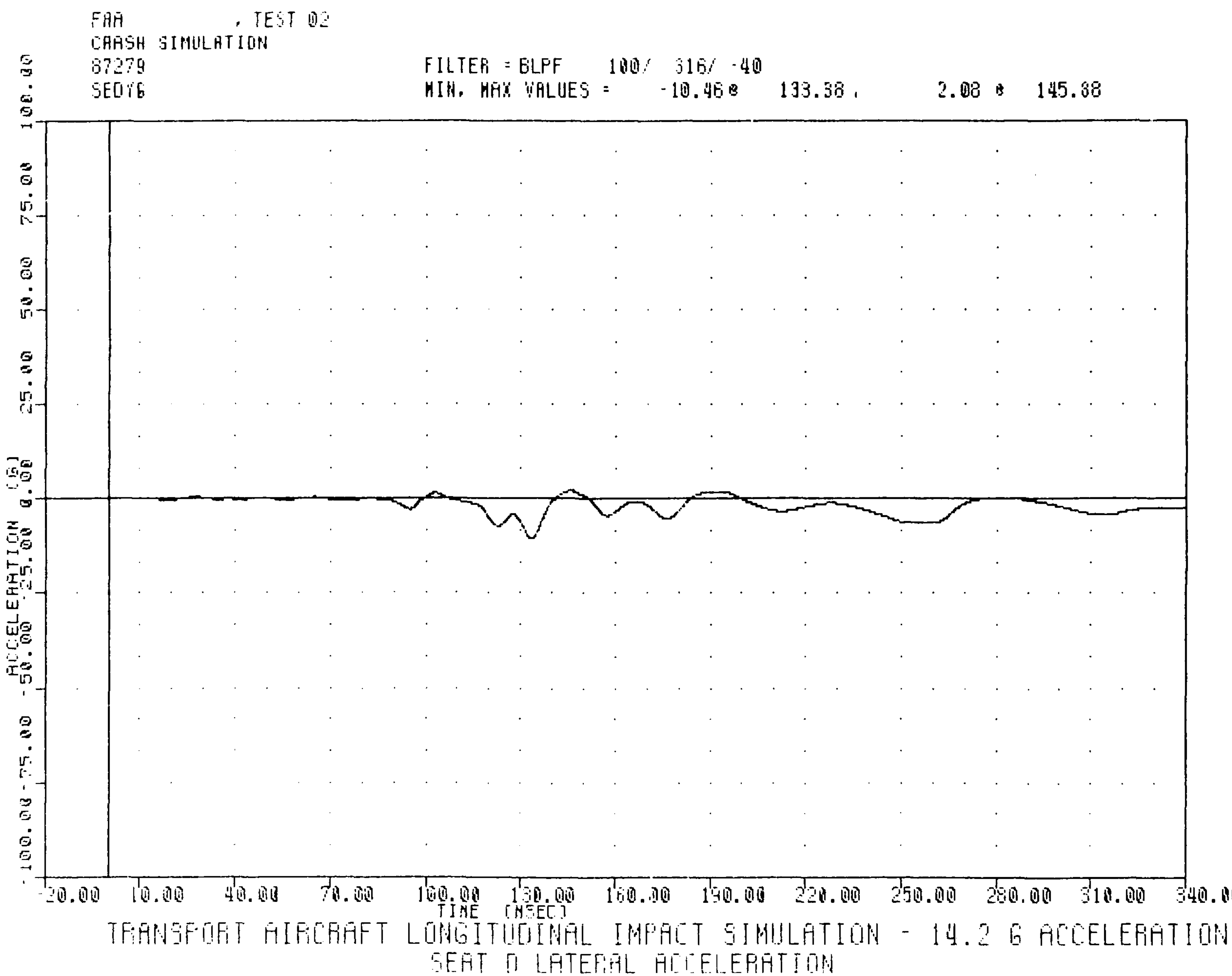
FILTER = 8LPF 100/ 316/ -40
MIN, MAX VALUES = -13.97 @ 76.63 , 2.46 @ 244.13



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT D LONGITUDINAL ACCELERATION

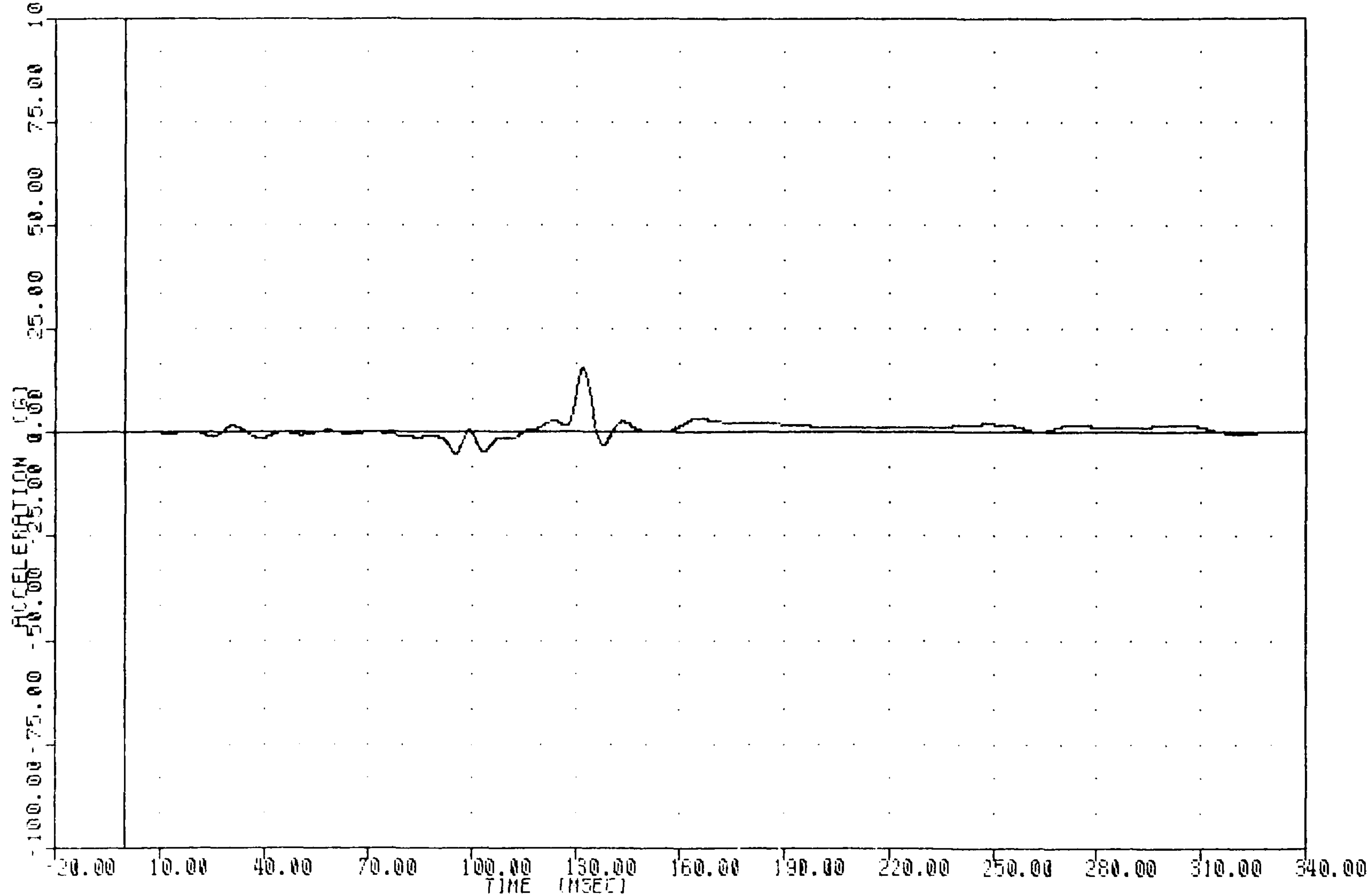


TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT A LONGITUDINAL VELOCITY


FAA , TEST 02
CRASH SIMULATION
87279
SEDY6
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -10.46 @ 133.38 , 2.08 @ 145.88
100.00
75.00
50.00
25.00
0.00
-25.00
-50.00
-75.00
-100.00
ACCELERATION (G)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT D LATERAL ACCELERATION

FAA , TEST 02
CRASH SIMULATION
87279
SEDZG

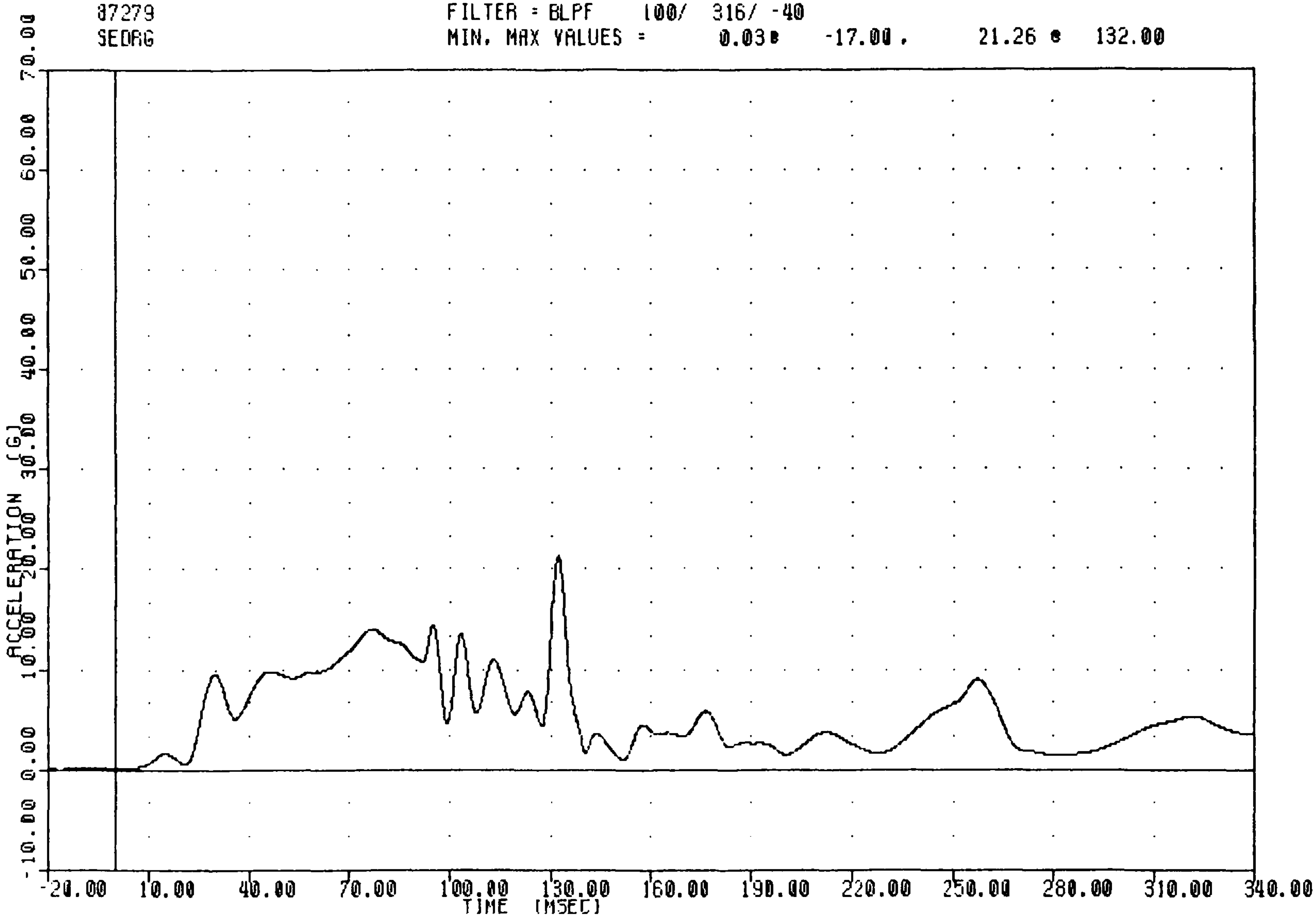
FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -4.98 @ 95.13 , 15.27 @ 131.88



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT D VERTICAL ACCELERATION

FAA , TEST 02
CRASH SIMULATION
87279
SEDAG

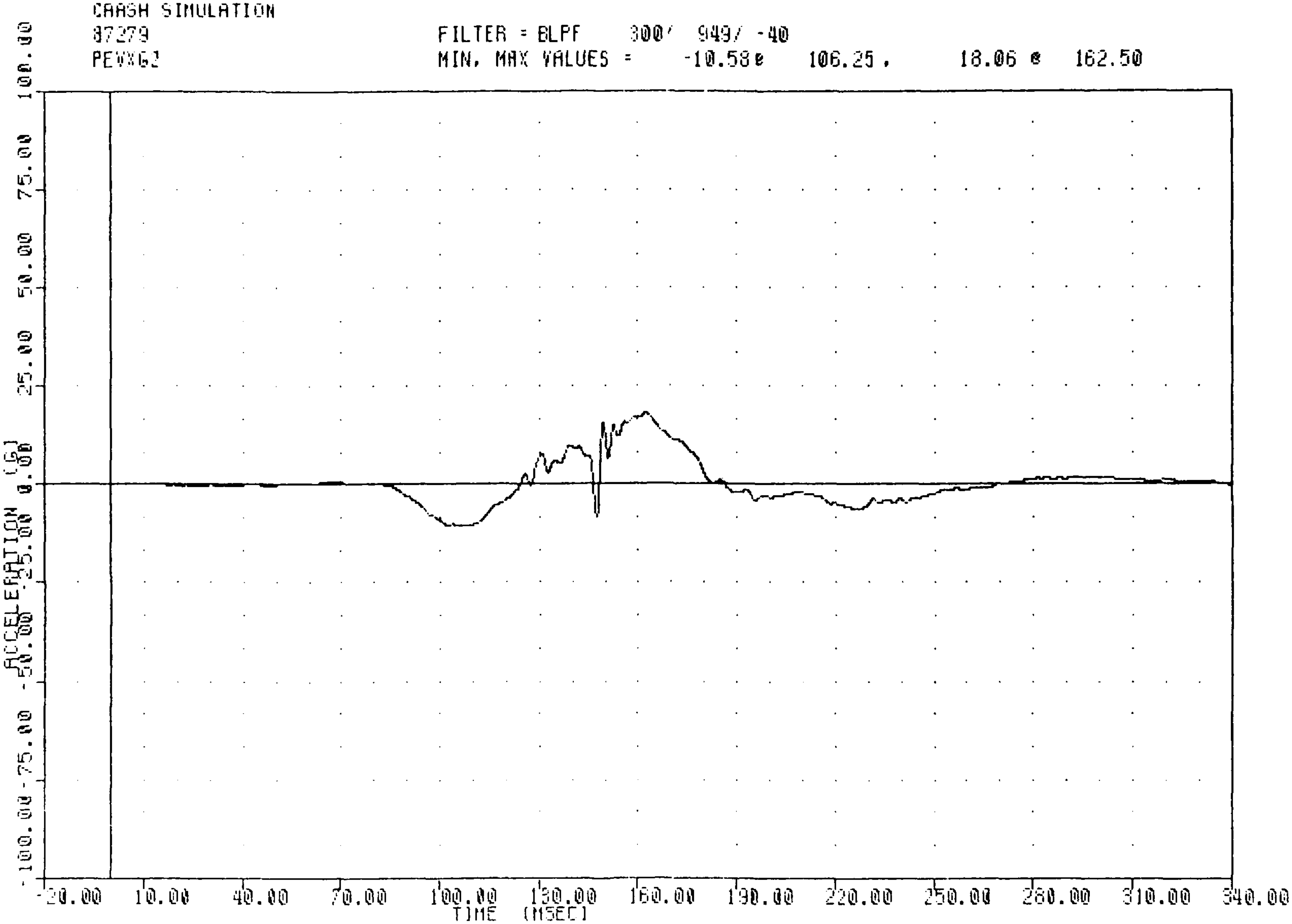
FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = 0.03 @ -17.00 , 21.26 @ 132.00



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT D ACCELERATION RESULTANT

FAA , TEST 02
CRASH SIMULATION
87279
PEVXG2

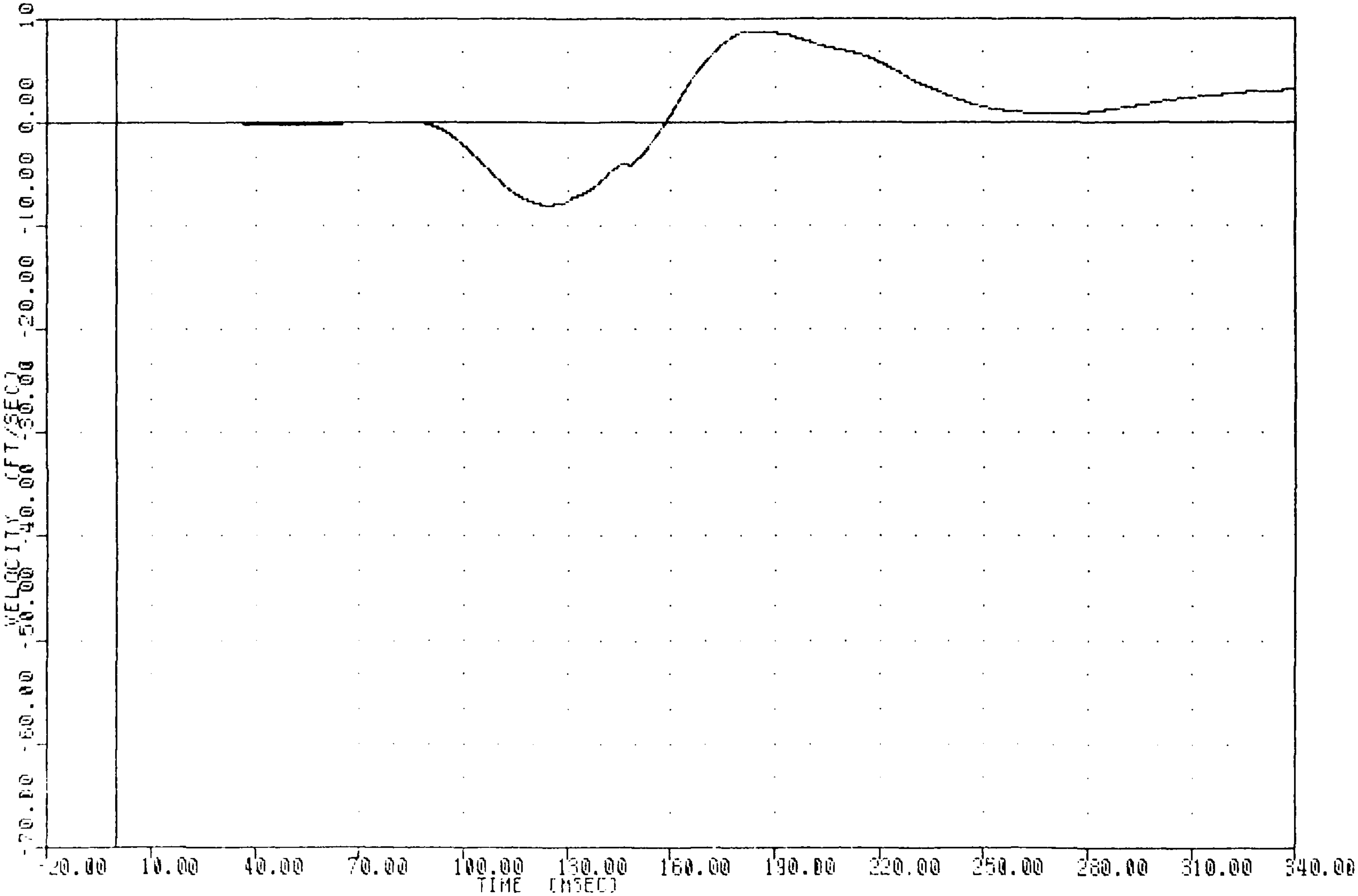
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -10.58 @ 106.25 , 18.06 @ 162.50



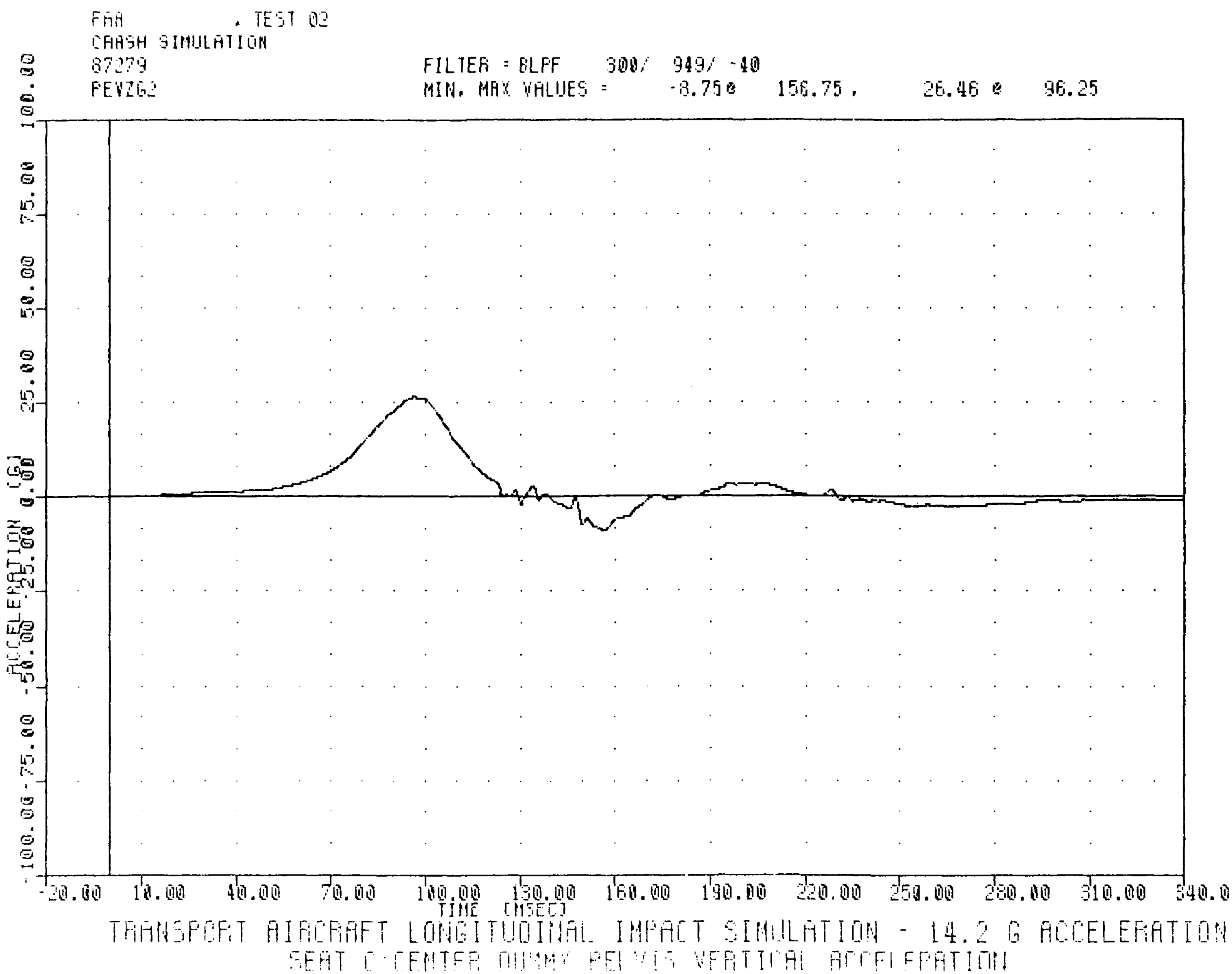
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT C CENTER DUMMY PELVIS LONGITUDINAL ACCELERATION

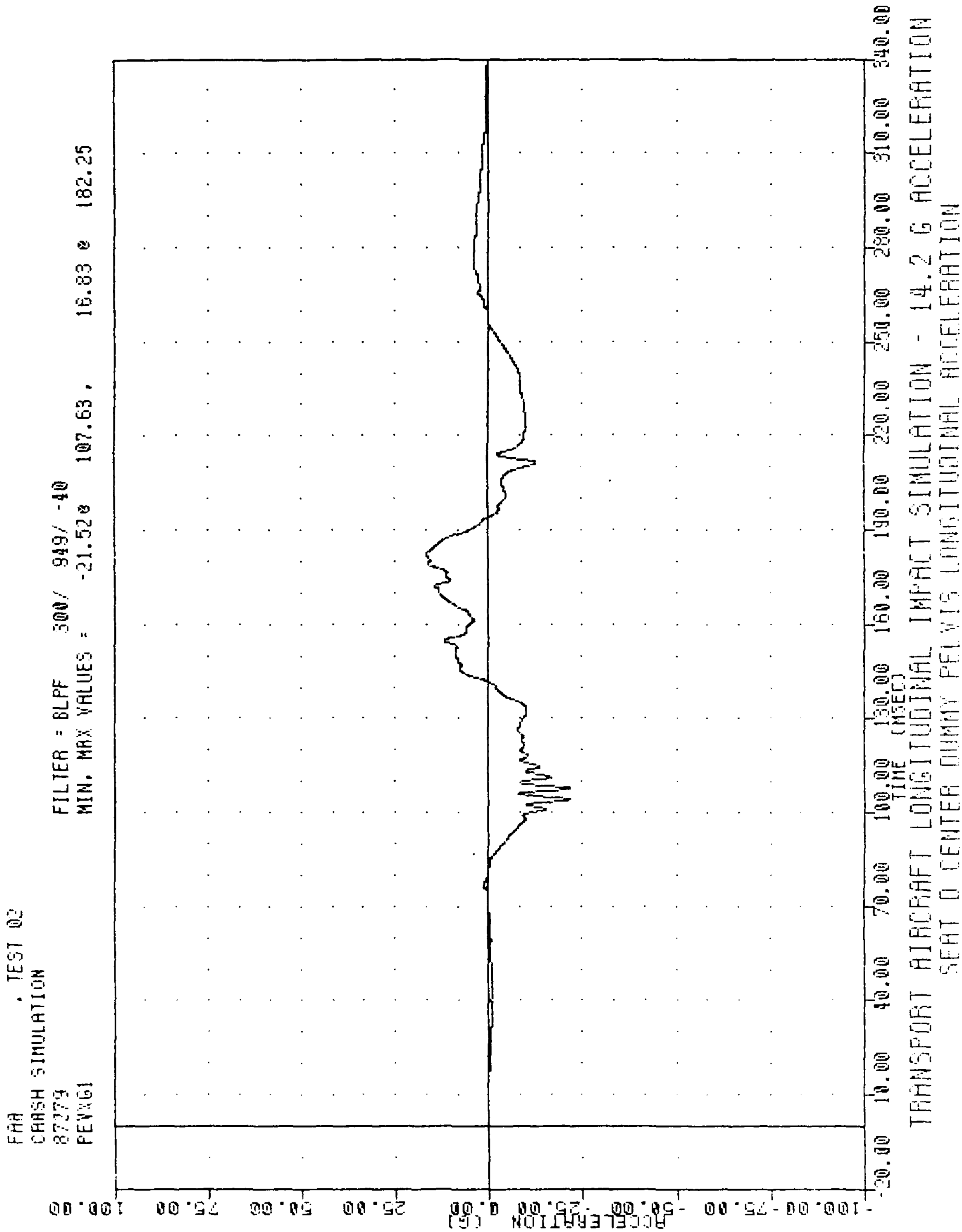
FAA , TEST 02
CRASH SIMULATION
87279
PEVXV2

FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -8.08 @ 124.38 , 8.75 @ 186.38

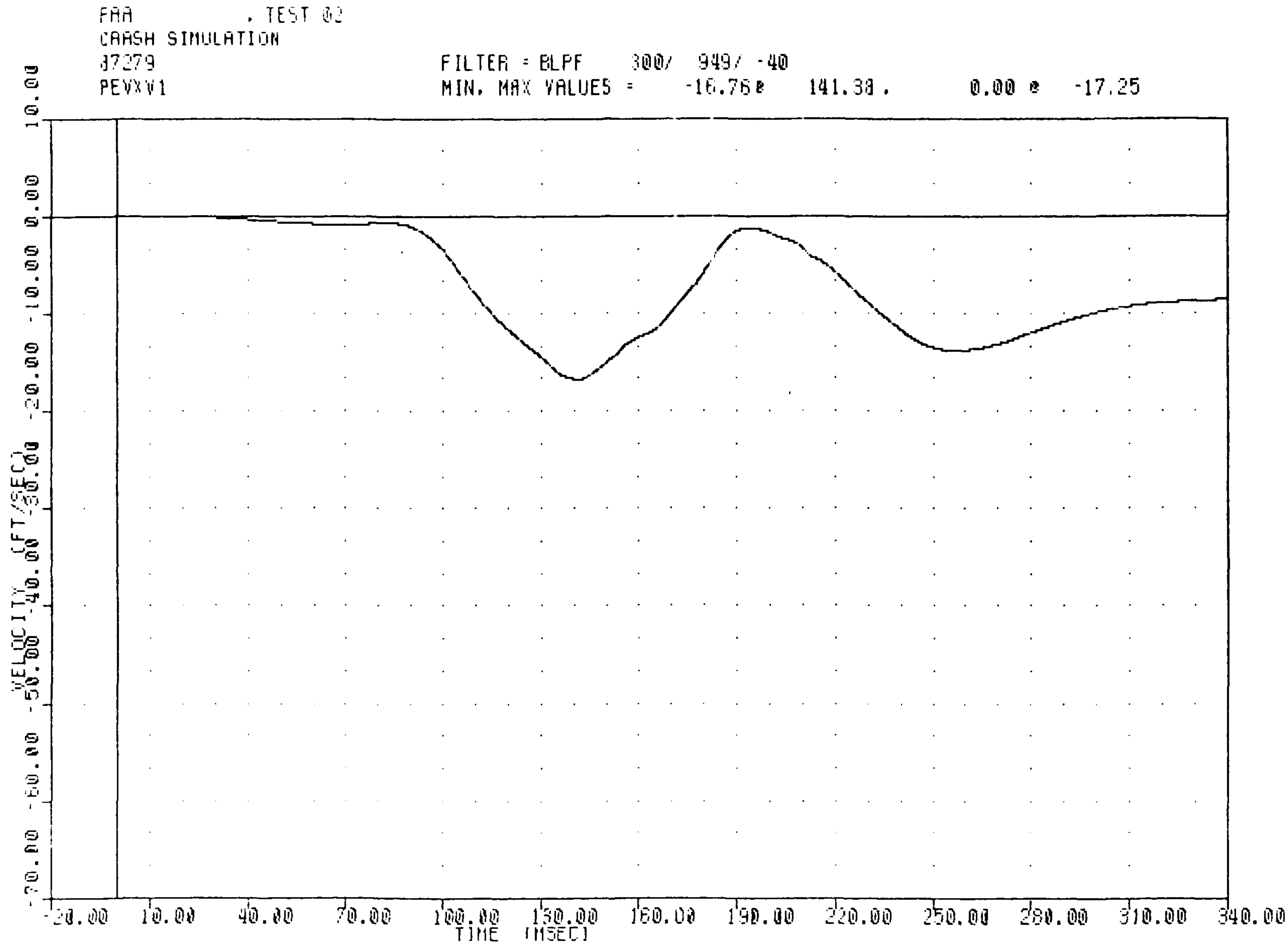


TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT F CENTER DUMMY PELVIS LONGITUDINAL VELOCITY


FAA , TEST 02
CRASH SIMULATION
87279
PEVZG2
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -8.75 @ 156.75 , 26.46 @ 96.25
100.00
75.00
50.00
25.00
0.00
-25.00
-50.00
-75.00
-100.00
ACCELERATION (G)
-20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00
TIME (MSEC)
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT C CENTER DUMMY PELVIS VERTICAL ACCELERATION



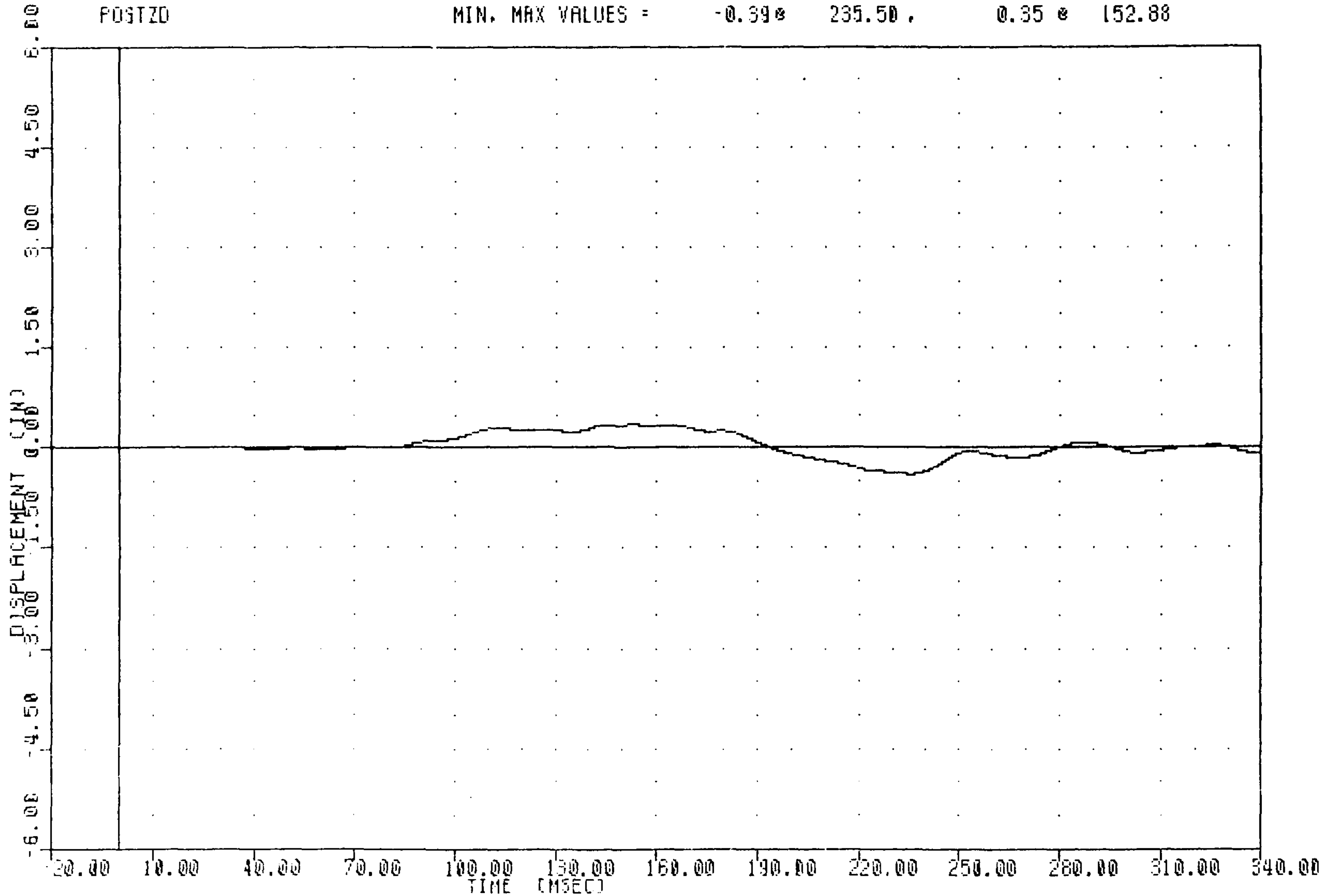
FAA
CRASH SIMULATION , TEST 02
87379
PEVXG1
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -21.52 @ 107.63 , 16.83 @ 182.25
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
100.00
75.00
50.00
25.00
0.00
-25.00
-50.00
-75.00
-100.00
ACCELERATION (G)
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT D CENTER DUMMY PELVIS LONGITUDINAL ACCELERATION



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT D CENTER DUMMY PELVIS LONGITUDINAL VELOCITY

FAA , TEST 02
CRASH SIMULATION
87279
POSTZD

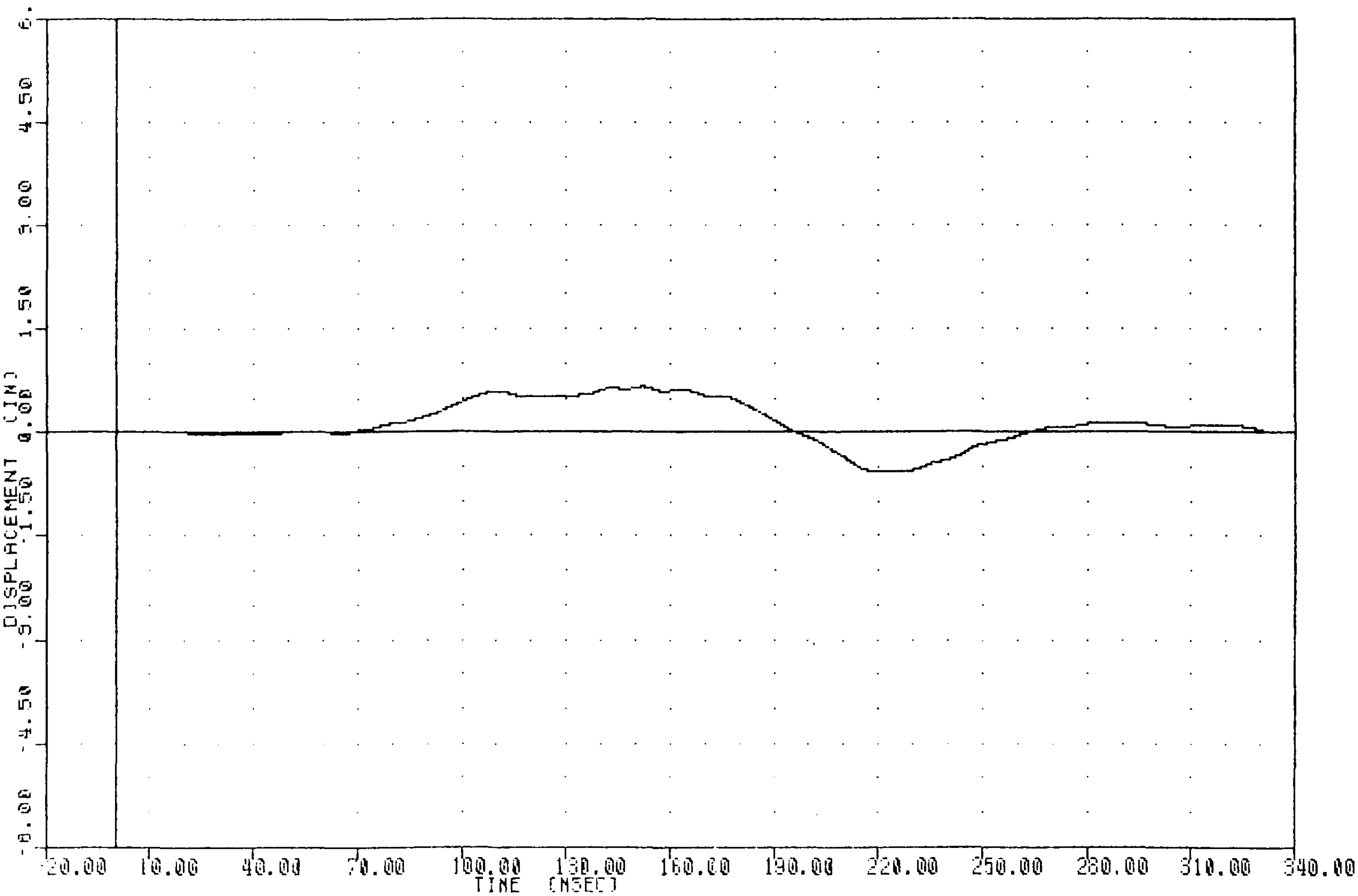
FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -0.39 @ 235.50 , 0.35 @ 152.88



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
PORT OUTBOARD SEAT TRACK DEFLECTION

FAA . TEST 02
CRASH SIMULATION
87279
PISTZD

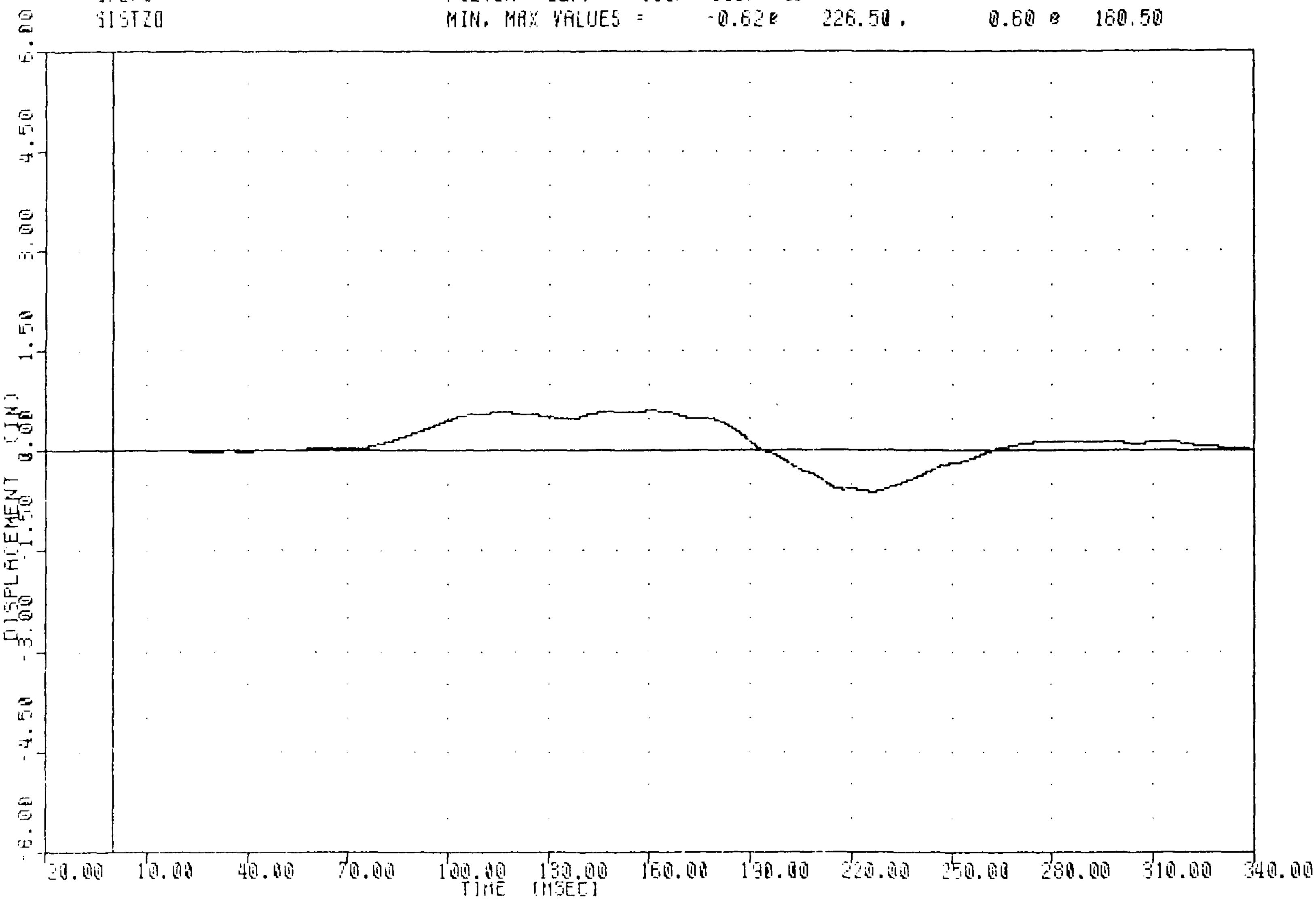
FILTER = BLFF 100/ 316/ -40
MIN, MAX VALUES = -0.57 @ 227.25 , 0.66 @ 152.13



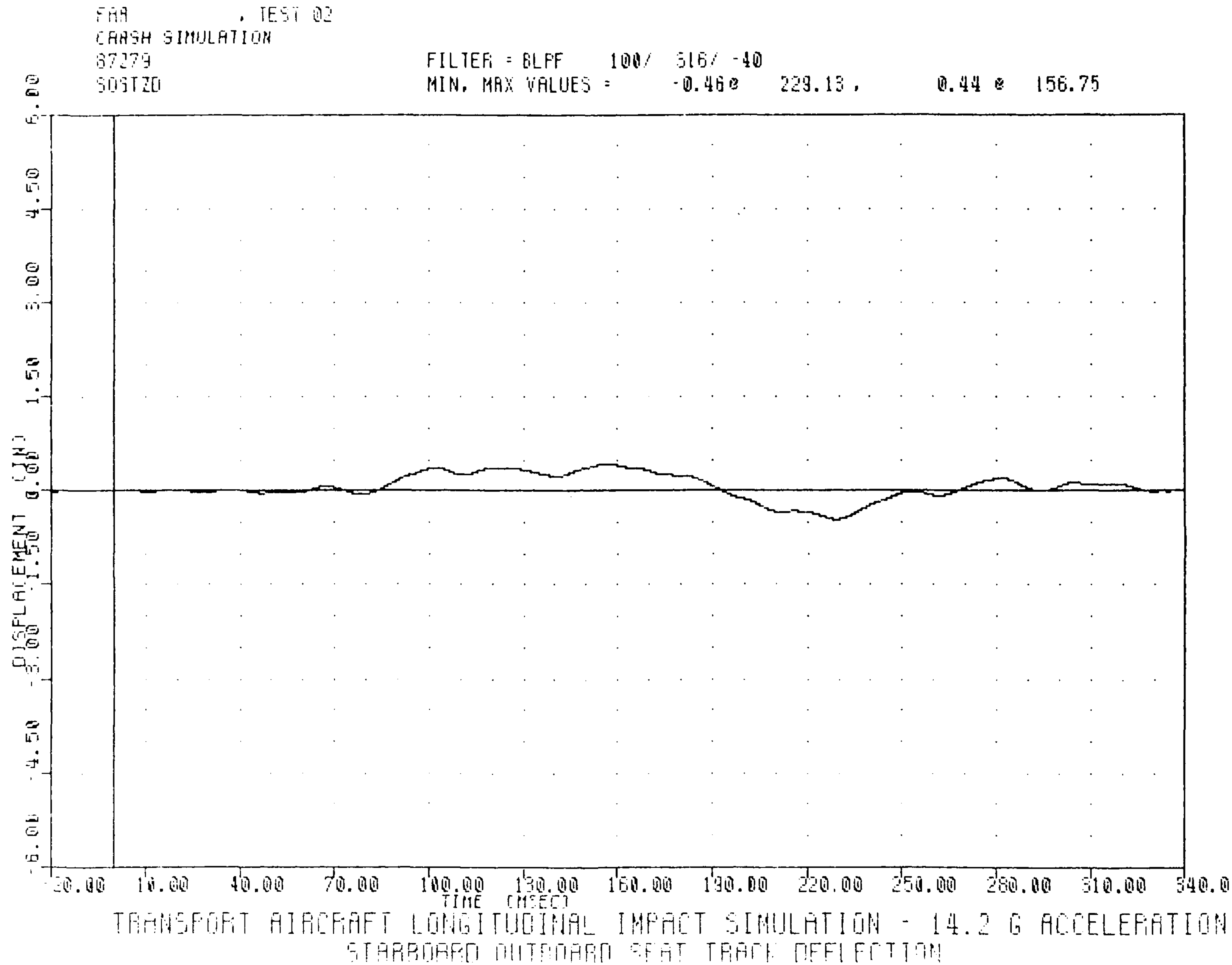
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
PORT INBOARD SEAT BACK DEFLECTION

FAA , TEST 02
CRASH SIMULATION
87279
SISTZO

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.62 @ 226.50 , 0.60 @ 160.50

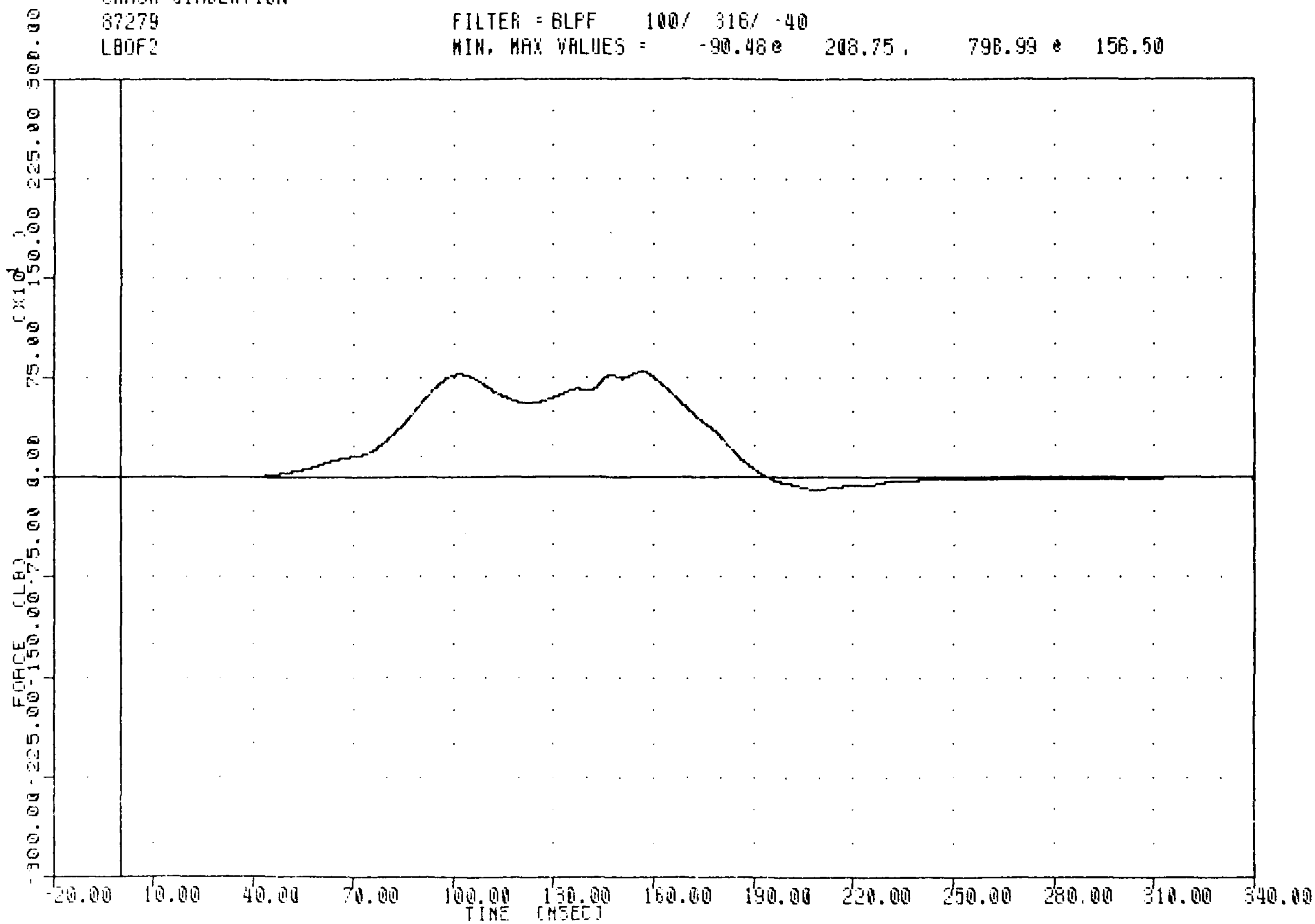


TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD INBOARD SEAT TRACK DEFLECTION

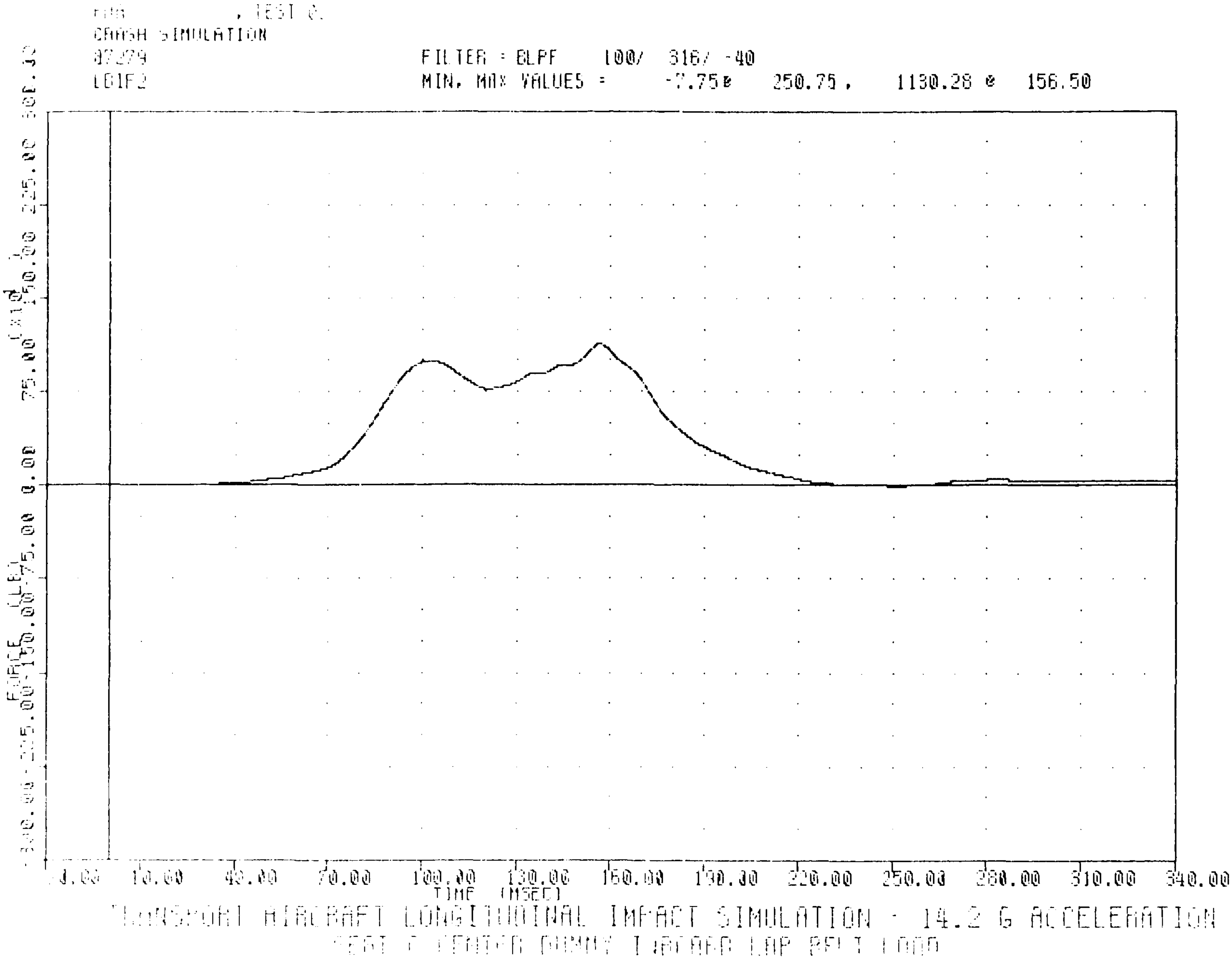

FAA , TEST 02
CRASH SIMULATION
87279
SOSTZD
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.46 @ 229.13 , 0.44 @ 156.75
6.00
4.50
3.00
1.50
0.00
-1.50
-3.00
-4.50
-6.00
DISPLACEMENT (IN)
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD OUTBOARD SEAT TRACK DEFLECTION

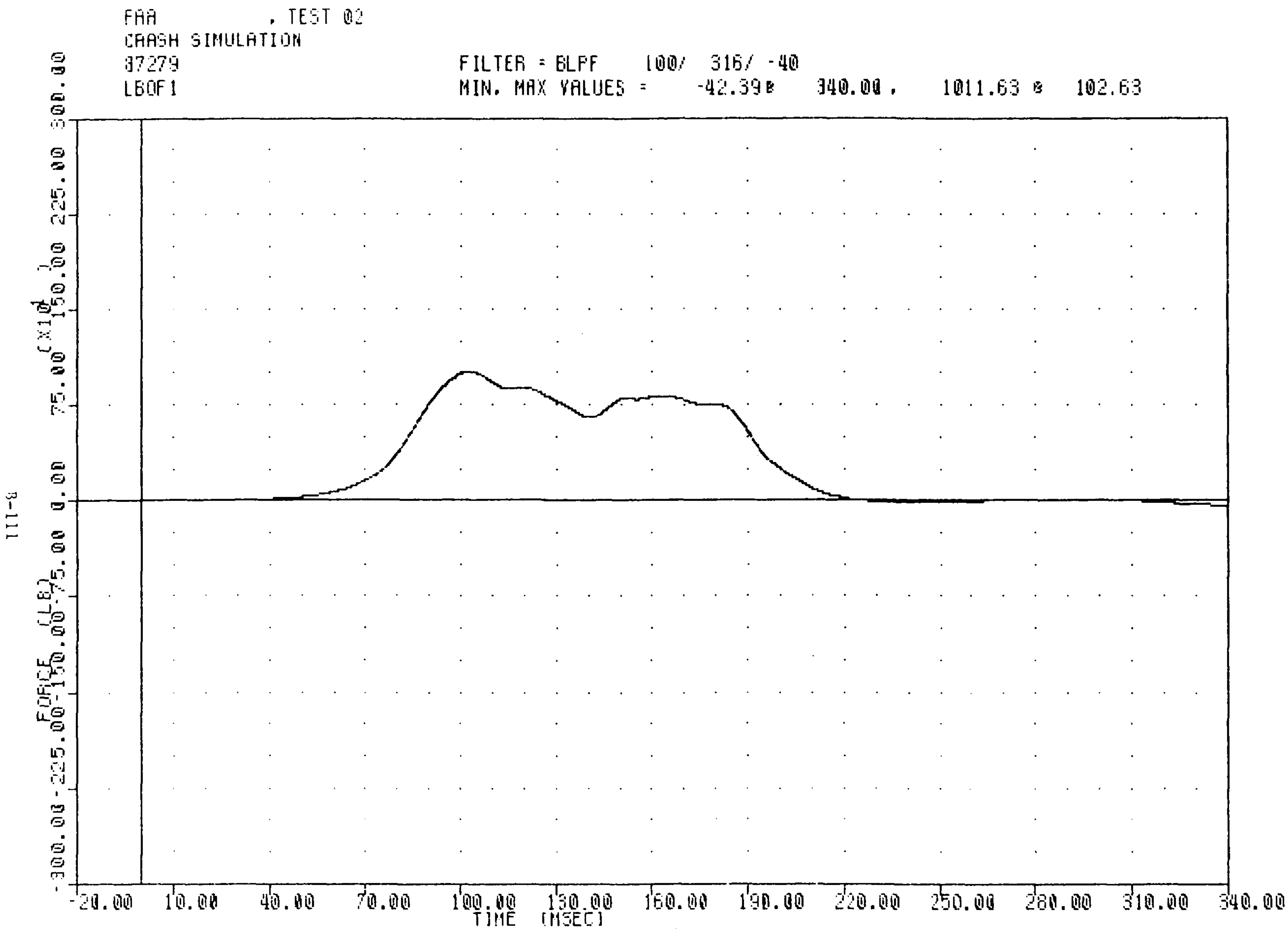
FAA , TEST 02
CRASH SIMULATION
87279
LBOF2

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -90.48 @ 208.75 , 798.99 @ 156.50



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT C CENTER DUMMY OUTBOARD LAP BELT LOAD

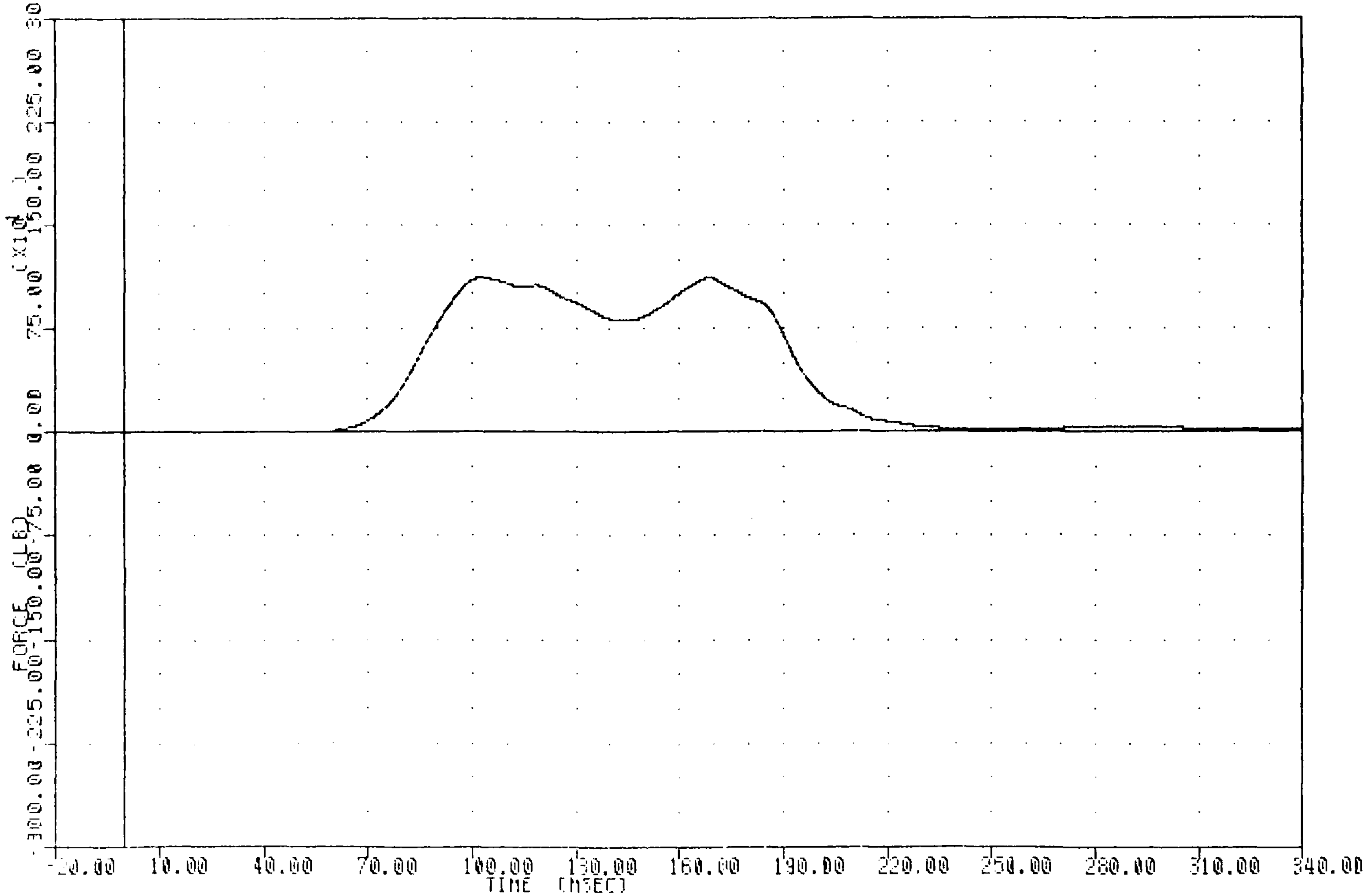

CRASH SIMULATION
LB1F2
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -7.75 @ 250.75 , 1130.28 @ 156.50
FORCE (LB)
(x10)
TIME (MSEC)
10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00
0.00 75.00 150.00 225.00
AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT D CENTER DUMMY OUTBOARD LAP BELT LOAD

FAA , TEST 02
CRASH SIMULATION
87279
LBIF1

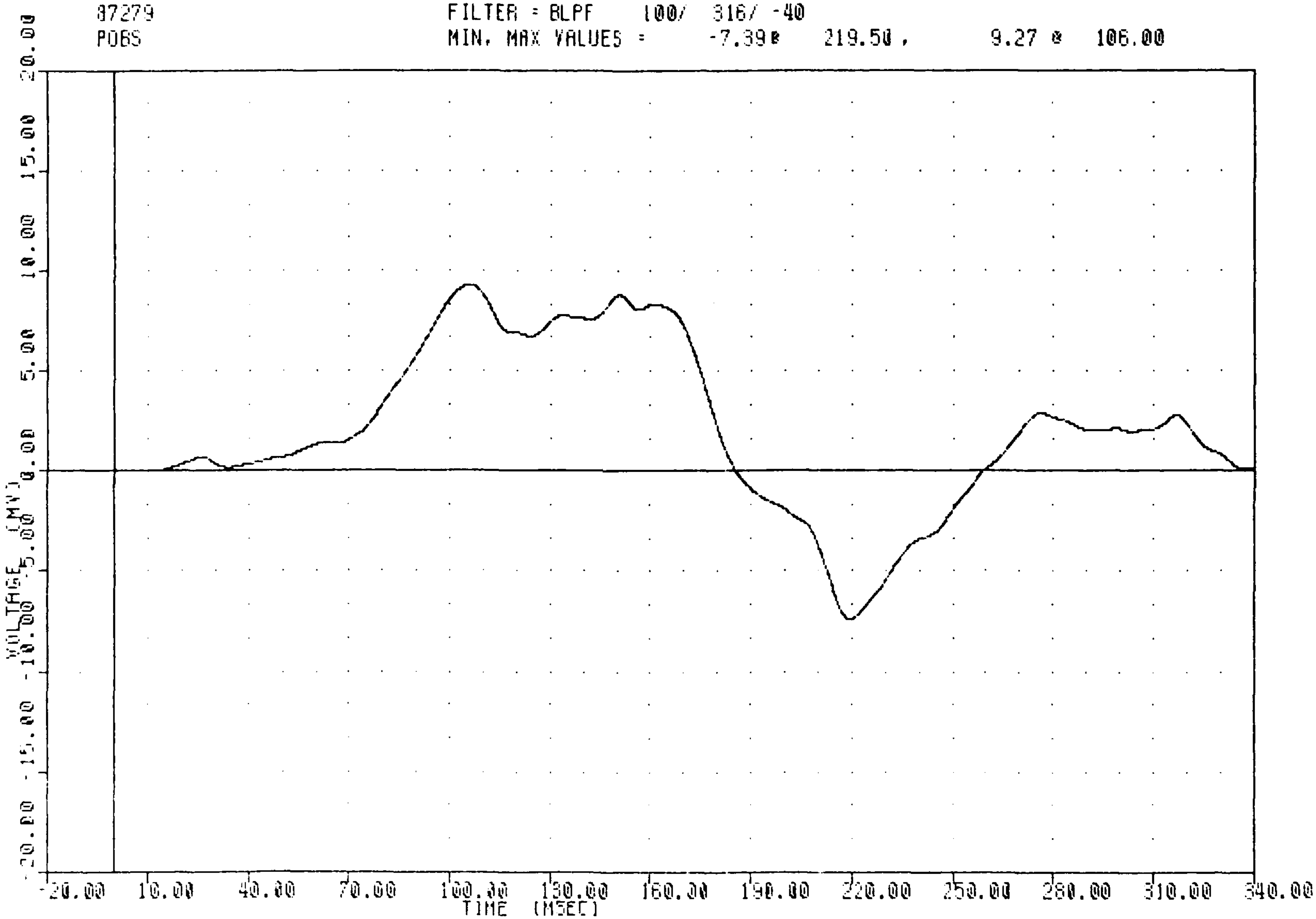
FILTER = BLFF 100/ 316/ -40
MIN, MAX VALUES = -2.90 @ 41.63 , 1116.21 @ 168.50



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT D CENTER DUMMY INBOARD LAP BELT LOAD

FAA , TEST 02
CRASH SIMULATION
87279
POBS

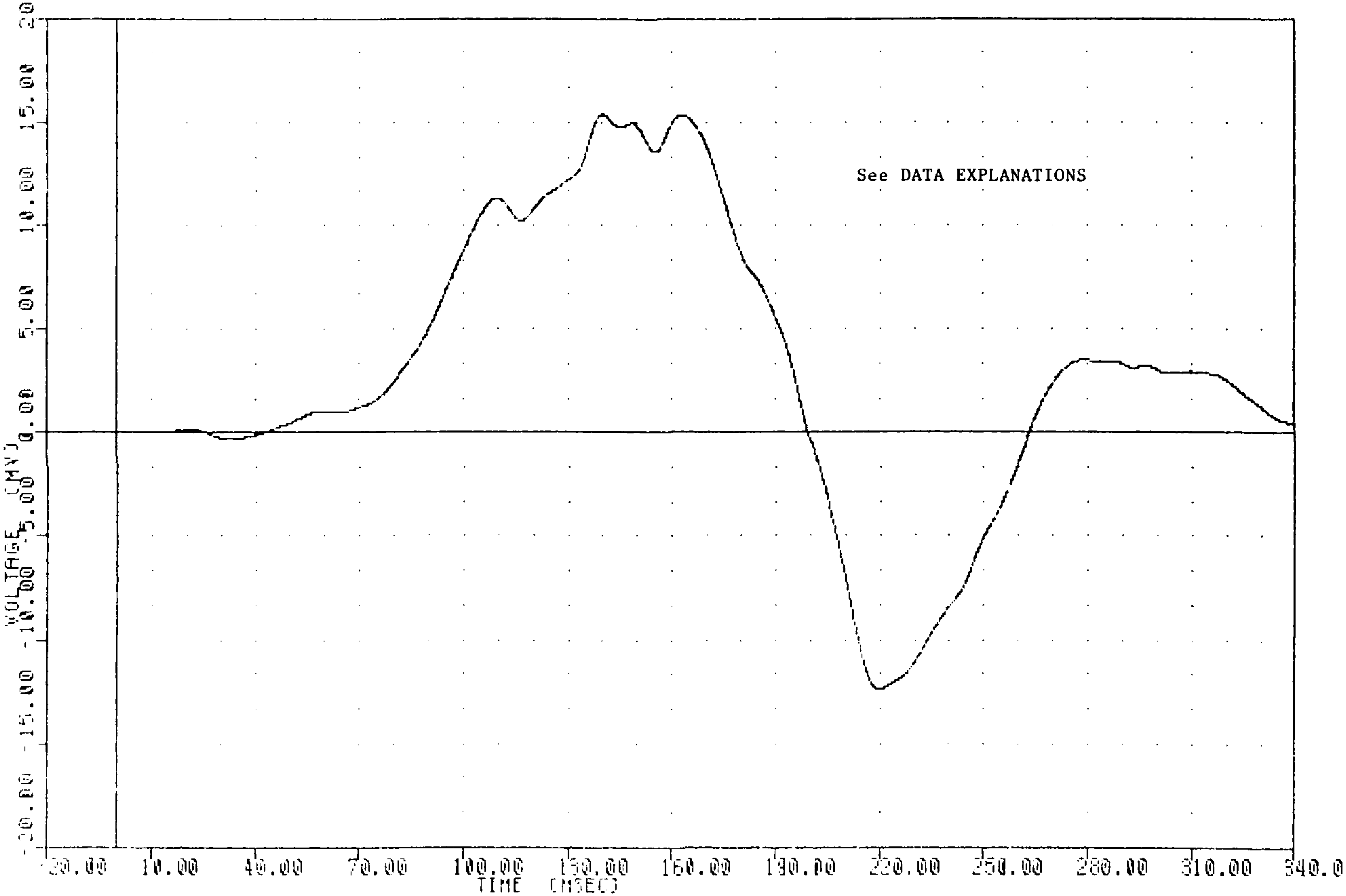
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -7.39 @ 219.50 , 9.27 @ 106.00



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
PORT OUTBOARD BEAM STRAIN

FAA . TEST 02
CRASH SIMULATION
87279
PIBS

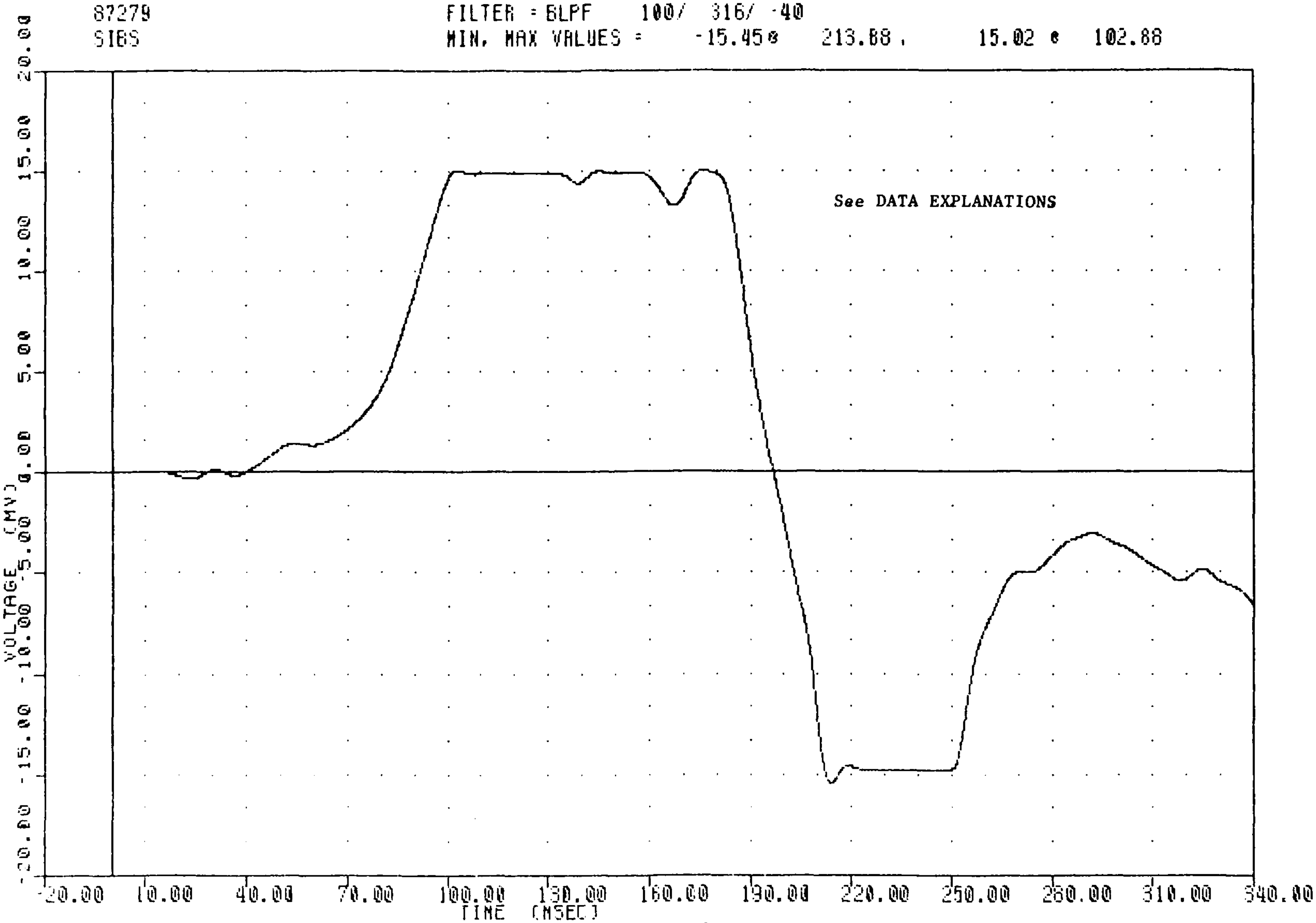
FILTER = BLFF 100/ 316/ -40
MIN, MAX VALUES = -12.43@ 219.88, 15.36 @ 139.88



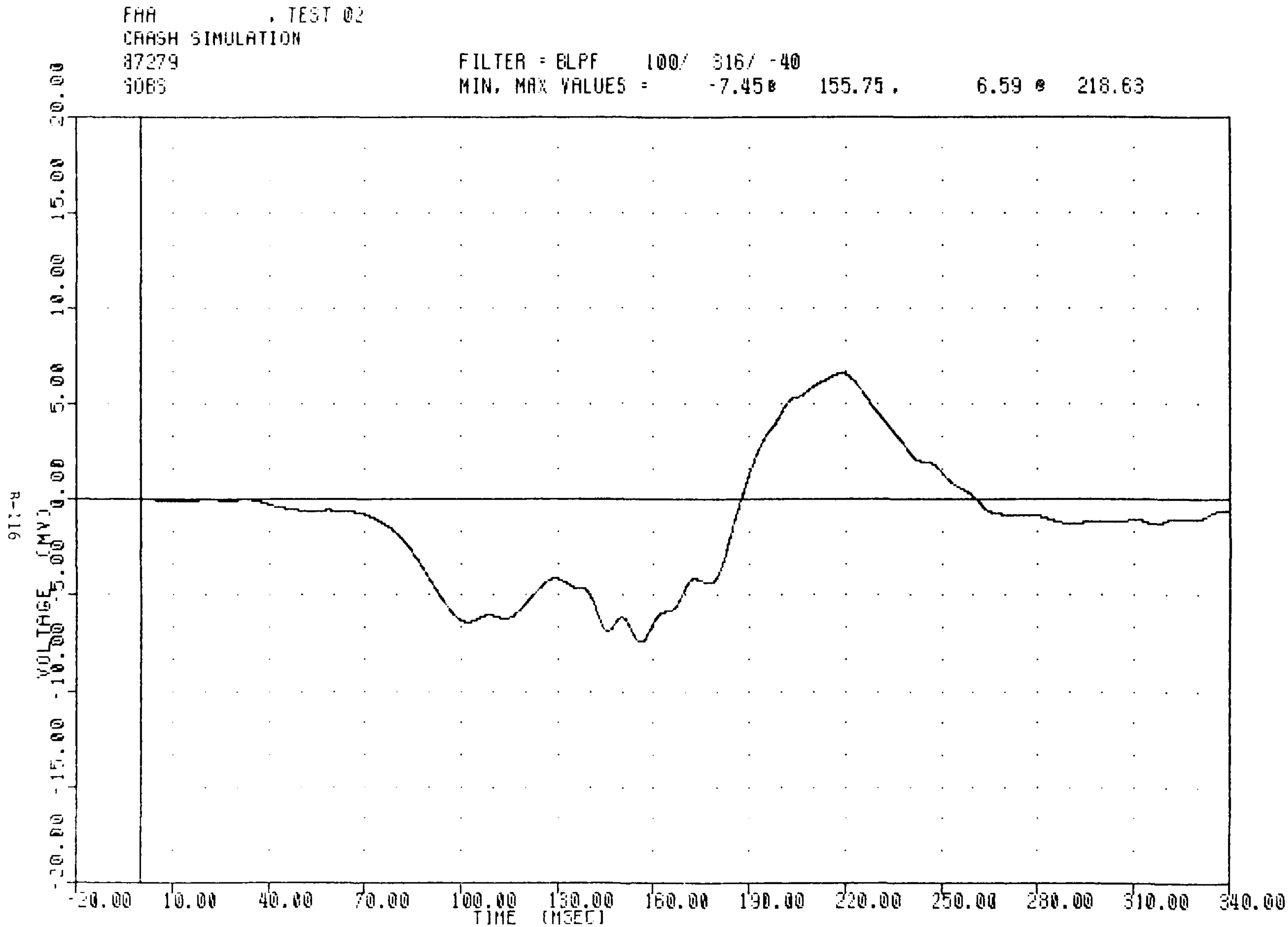
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
PART INBOARD BEAM STRAIN

FAA , TEST 02
CRASH SIMULATION
87279
SIBS

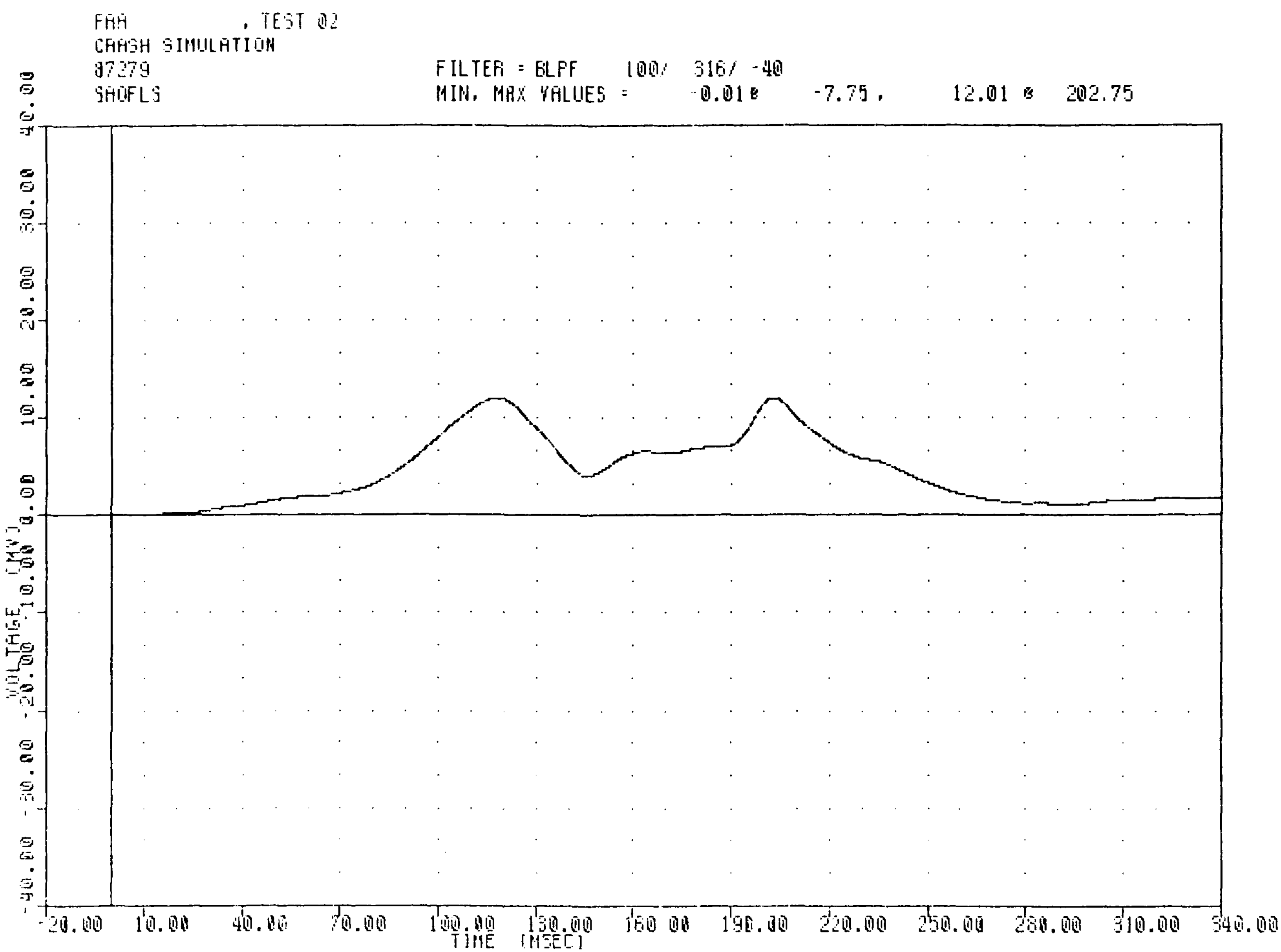
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -15.45 @ 213.88 , 15.02 @ 102.88



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD INBOARD BEAM STRAIN



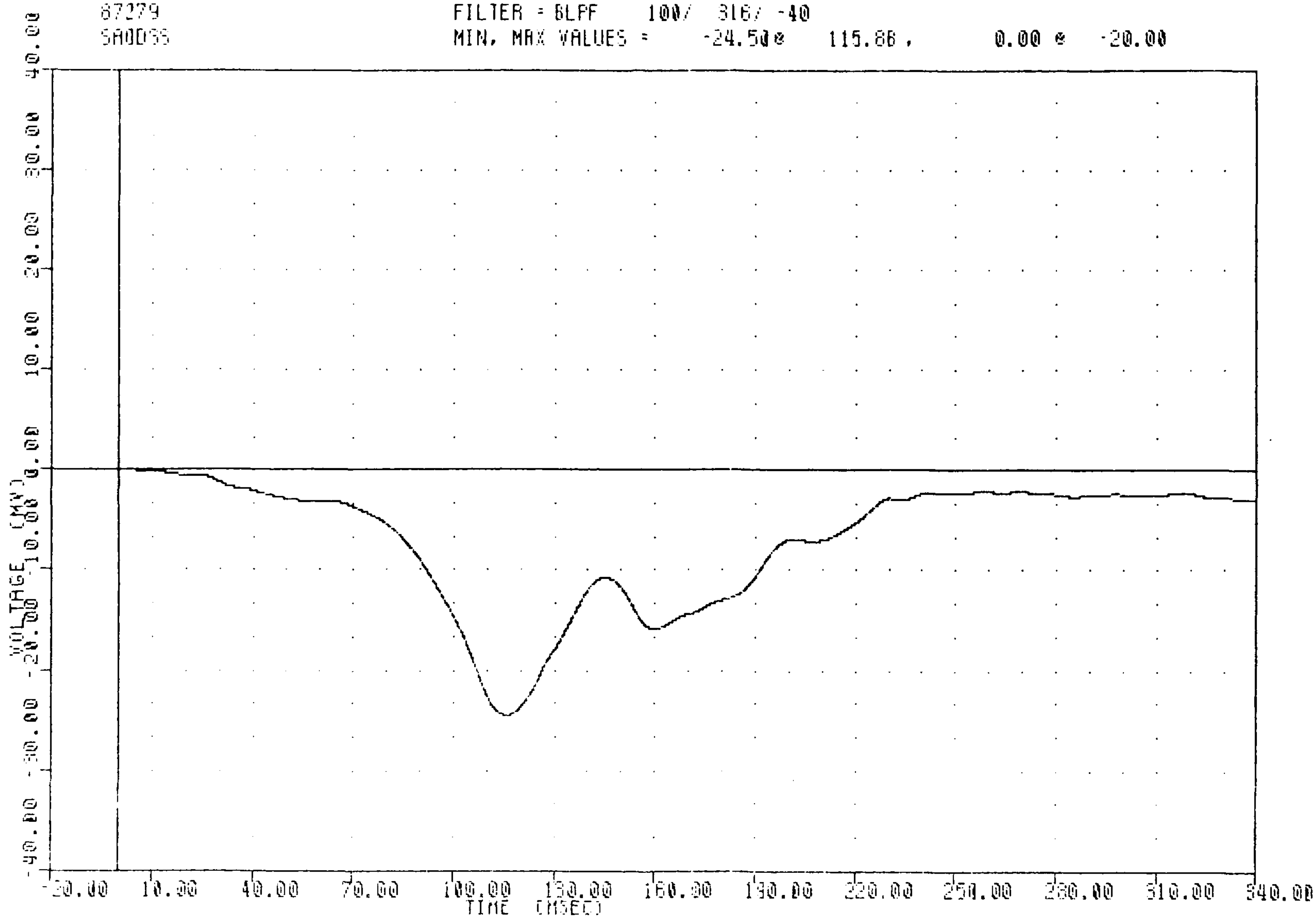
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
STARBOARD OUTBOARD BEAM STRAIN



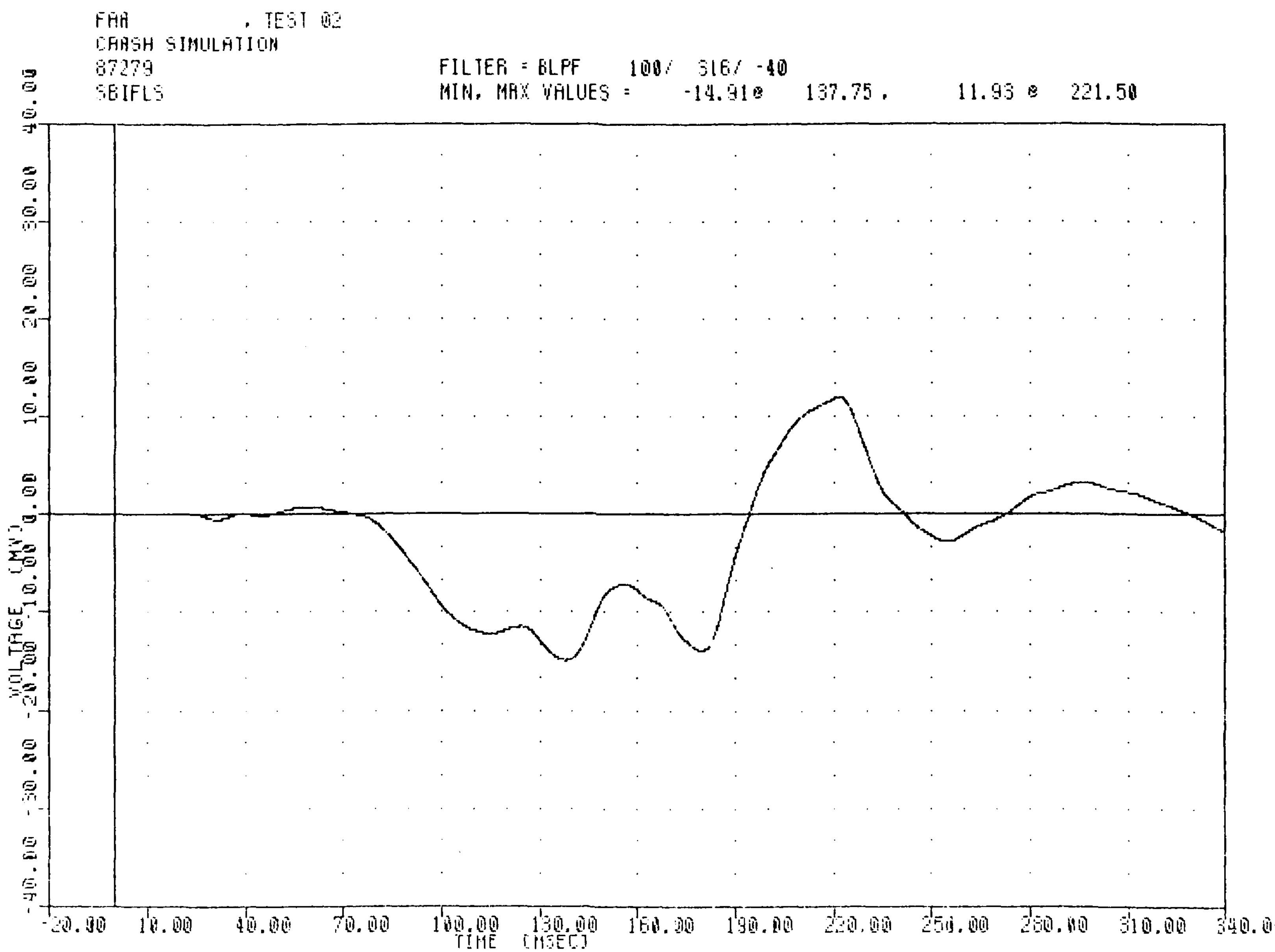
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT A OUTBOARD FORWARD LEG STRAIN

FAA , TEST 02
CRASH SIMULATION
87279
SA0DSS

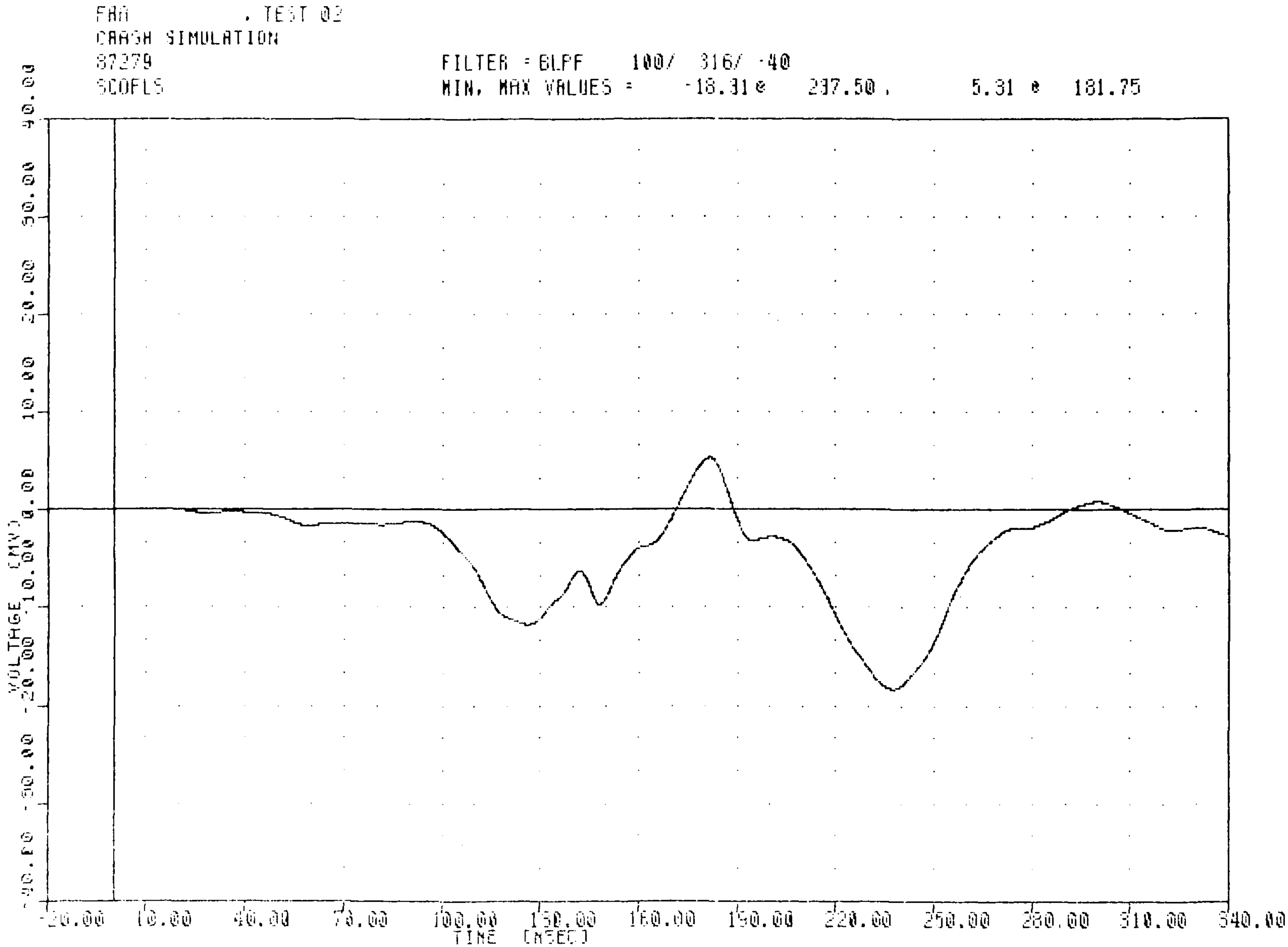
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -24.50 @ 115.88 , 0.00 @ -20.00



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT 9 OUTBOARD DIAGONAL STRUT STRAIN

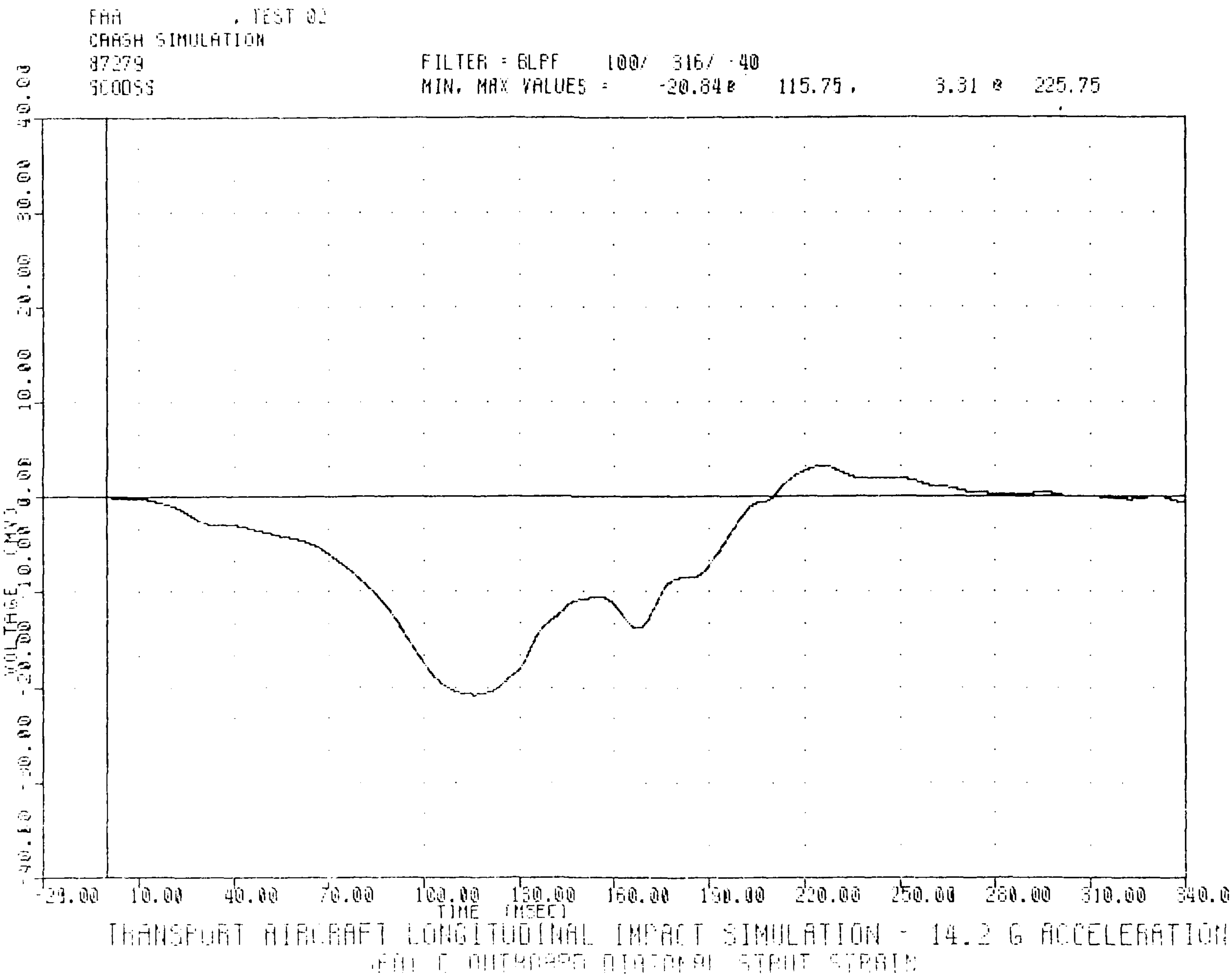


TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.7 G ACCELERATION
SEAT B INBOARD FORWARD LEG STRAIN



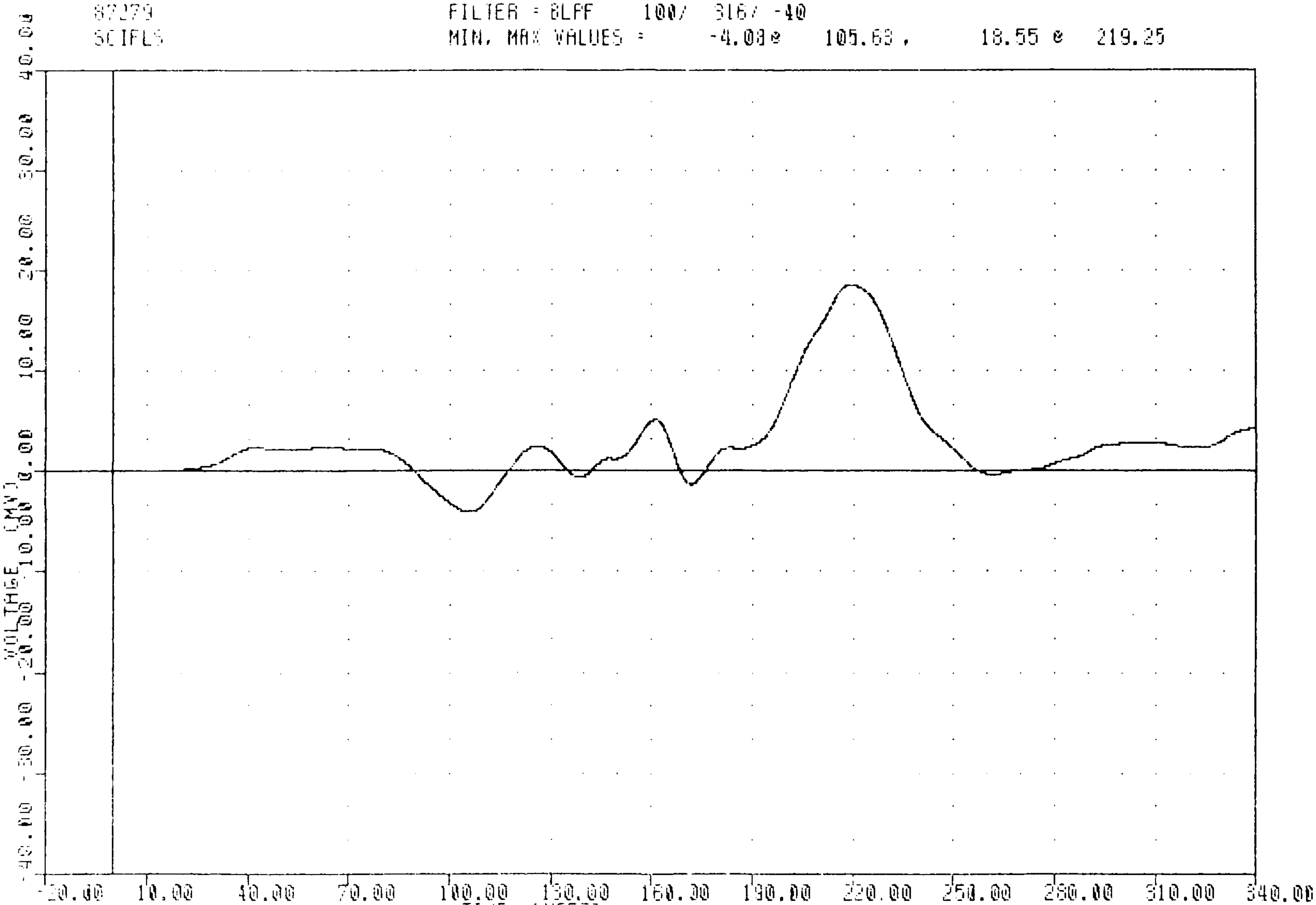
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION

SEAT C OUTBOARD FORWARD LEFT STRAIN


FAA , TEST 02
CRASH SIMULATION
87279
SCOOSS
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -20.84 @ 115.75 , 3.31 @ 225.75
VOLTAGE (MV)
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-20.00
10.00
40.00
70.00
100.00
130.00
160.00
190.00
220.00
250.00
280.00
310.00
340.00
TIME (MSEC)
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION

FAA , TEST 02
CRASH SIMULATION
87279
SCIFLS

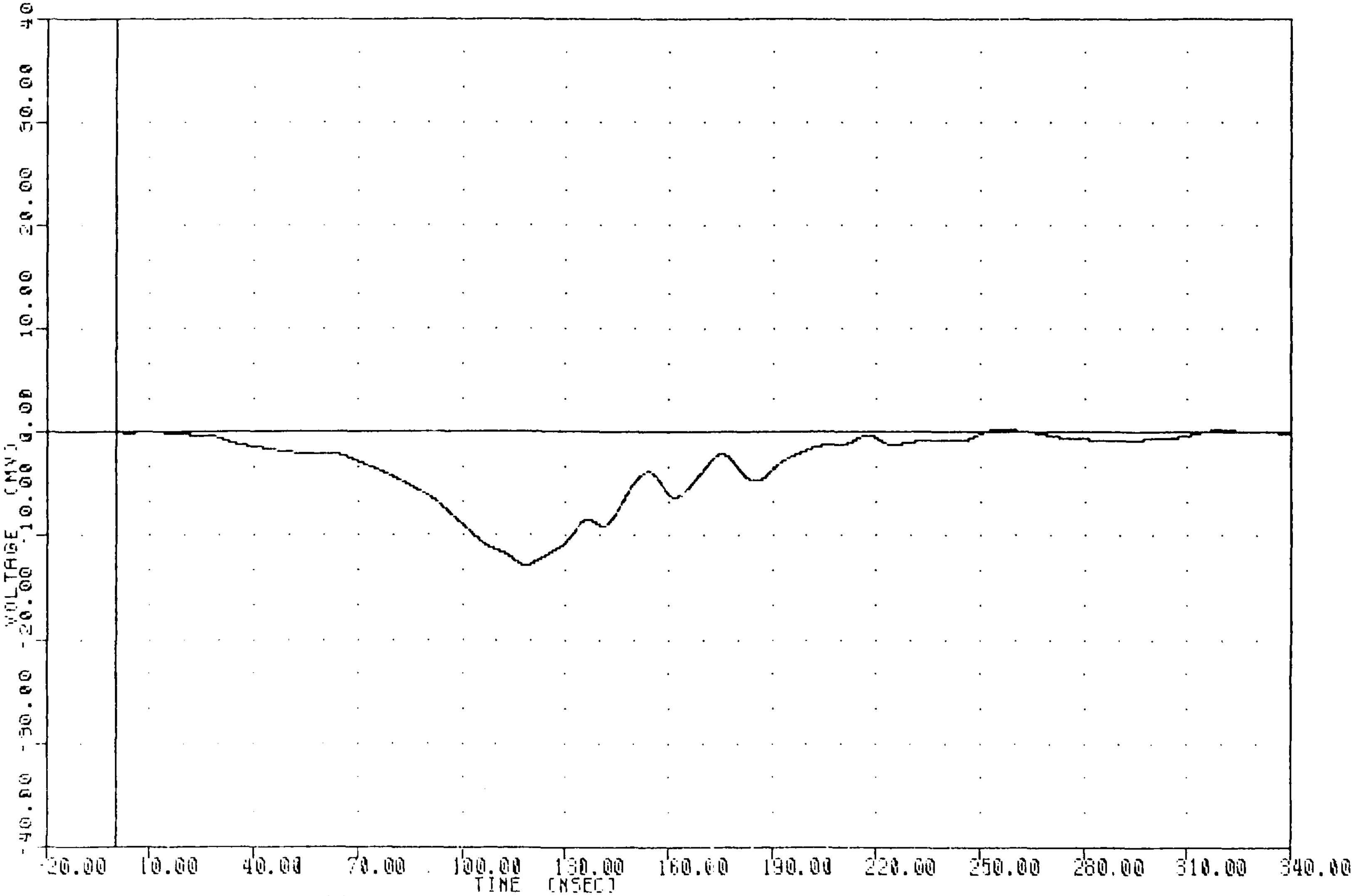
FILTER = 8LPF 100/ 316/ -40
MIN, MAX VALUES = -4.08 @ 105.63 , 18.55 @ 219.25



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT C INBOARD FORWARD LEG STRAIN

FAA , TEST 02
CRASH SIMULATION
87279
SCID55

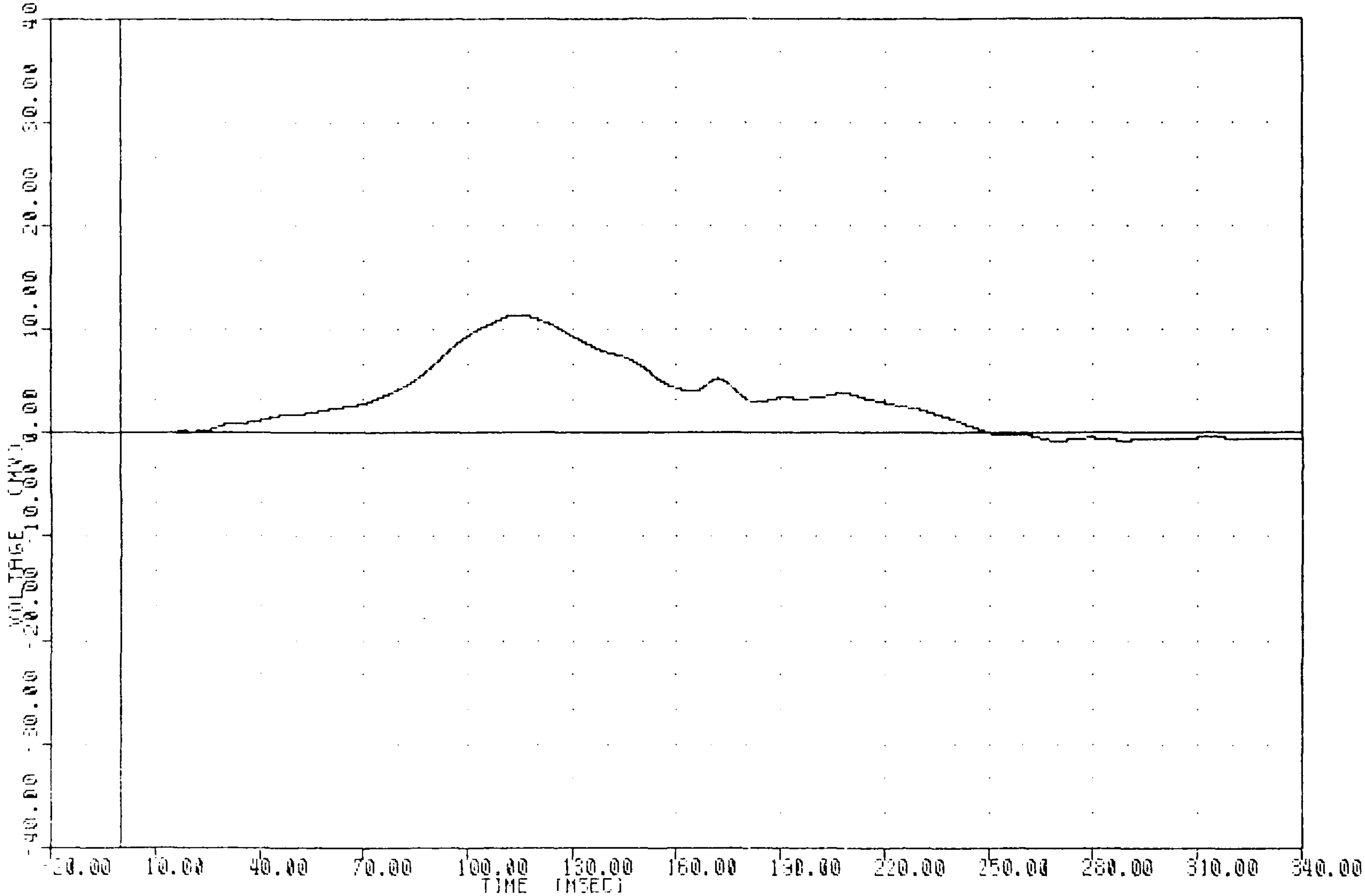
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -12.86 @ 118.38 , 0.32 @ 255.38



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT C INBOARD DIAGONAL STRUT STRAIN

FAA , TEST 02
CRASH SIMULATION
87279
SDOFLS

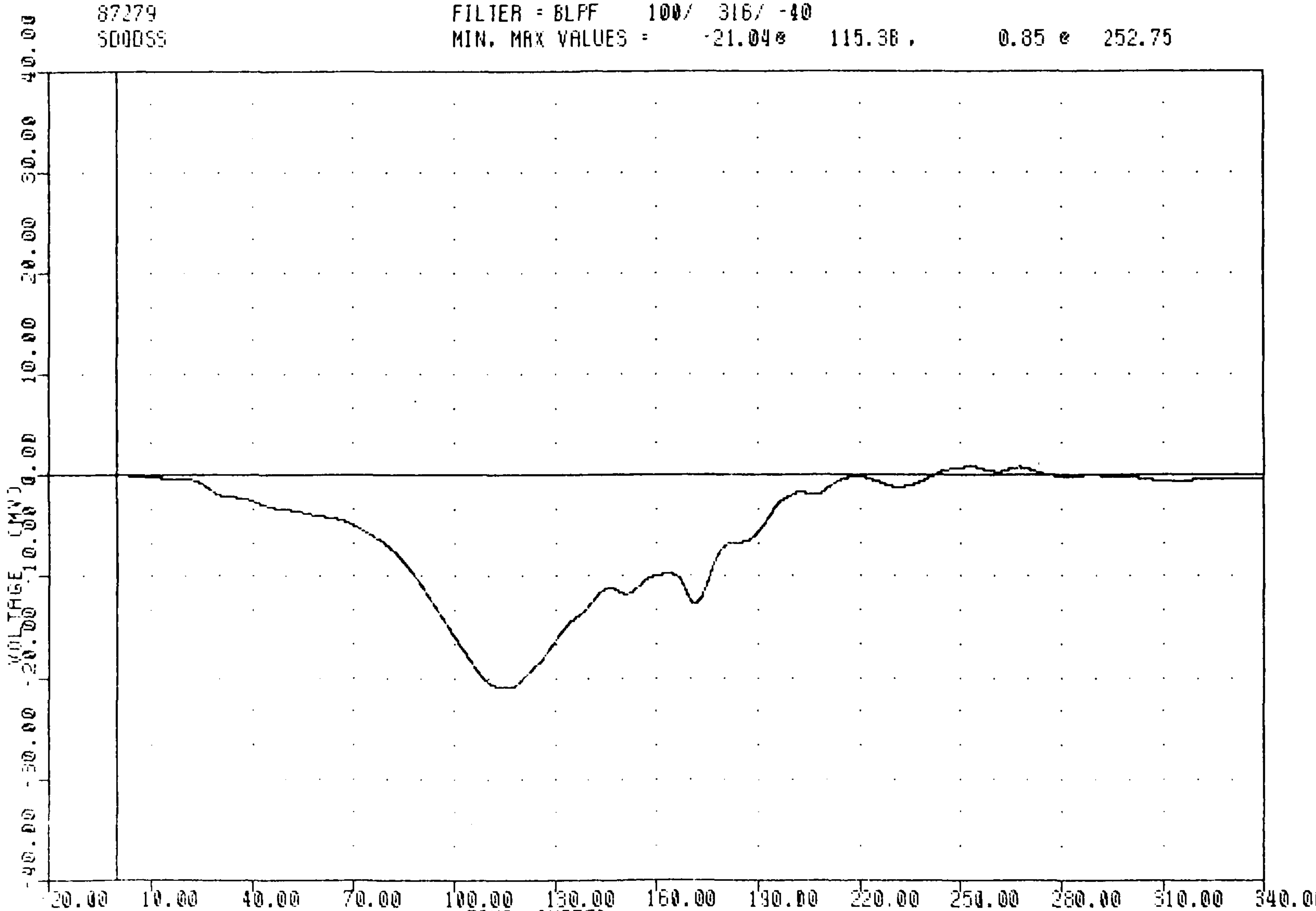
FILTER : BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.74 @ 269.75 , 11.39 @ 114.25



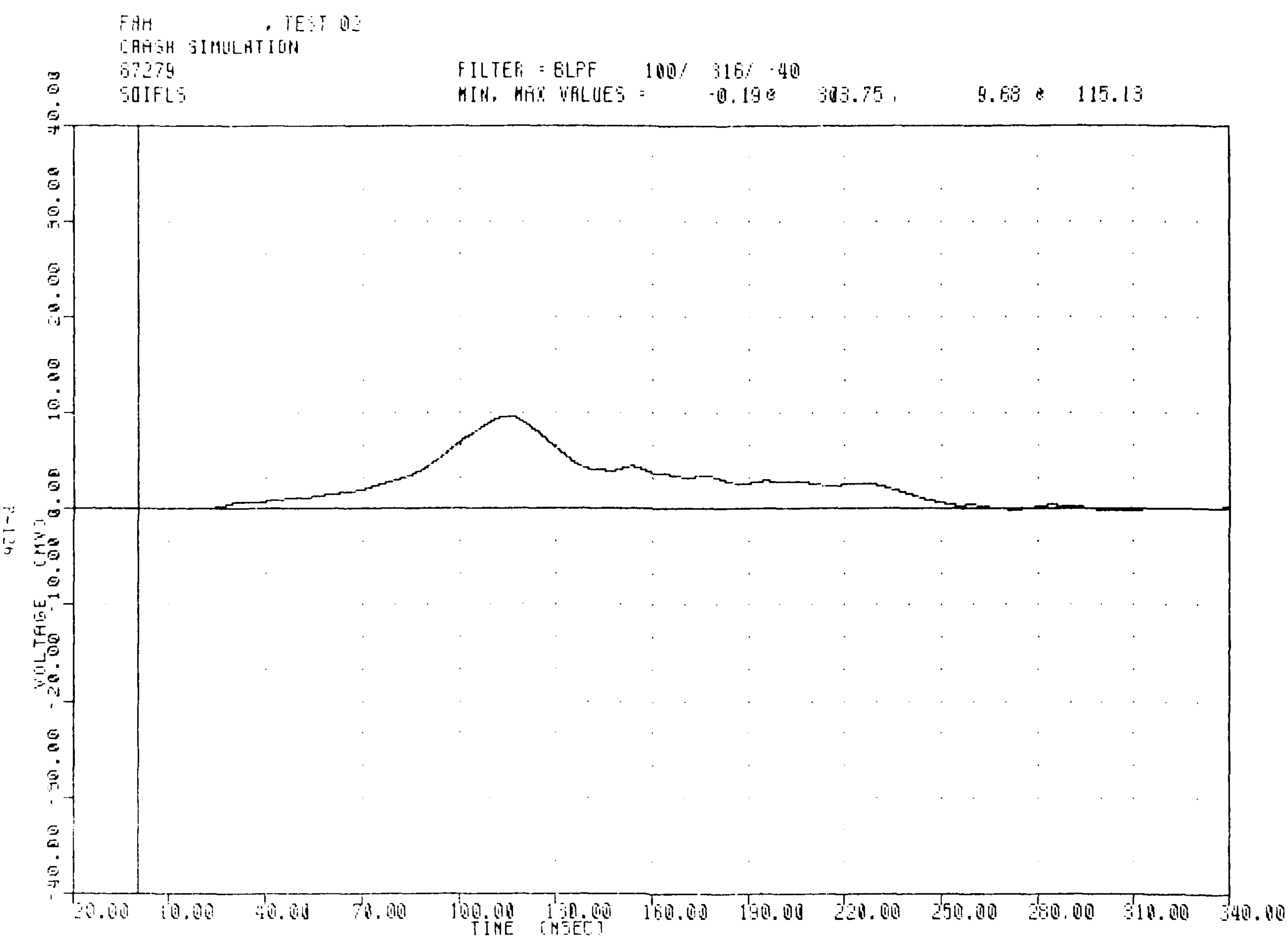
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT D OUTBOARD FORWARD LEG STRAIN

FAA , TEST 02
CRASH SIMULATION
87279
SDODSS

FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -21.04 @ 115.38 , 0.85 @ 252.75



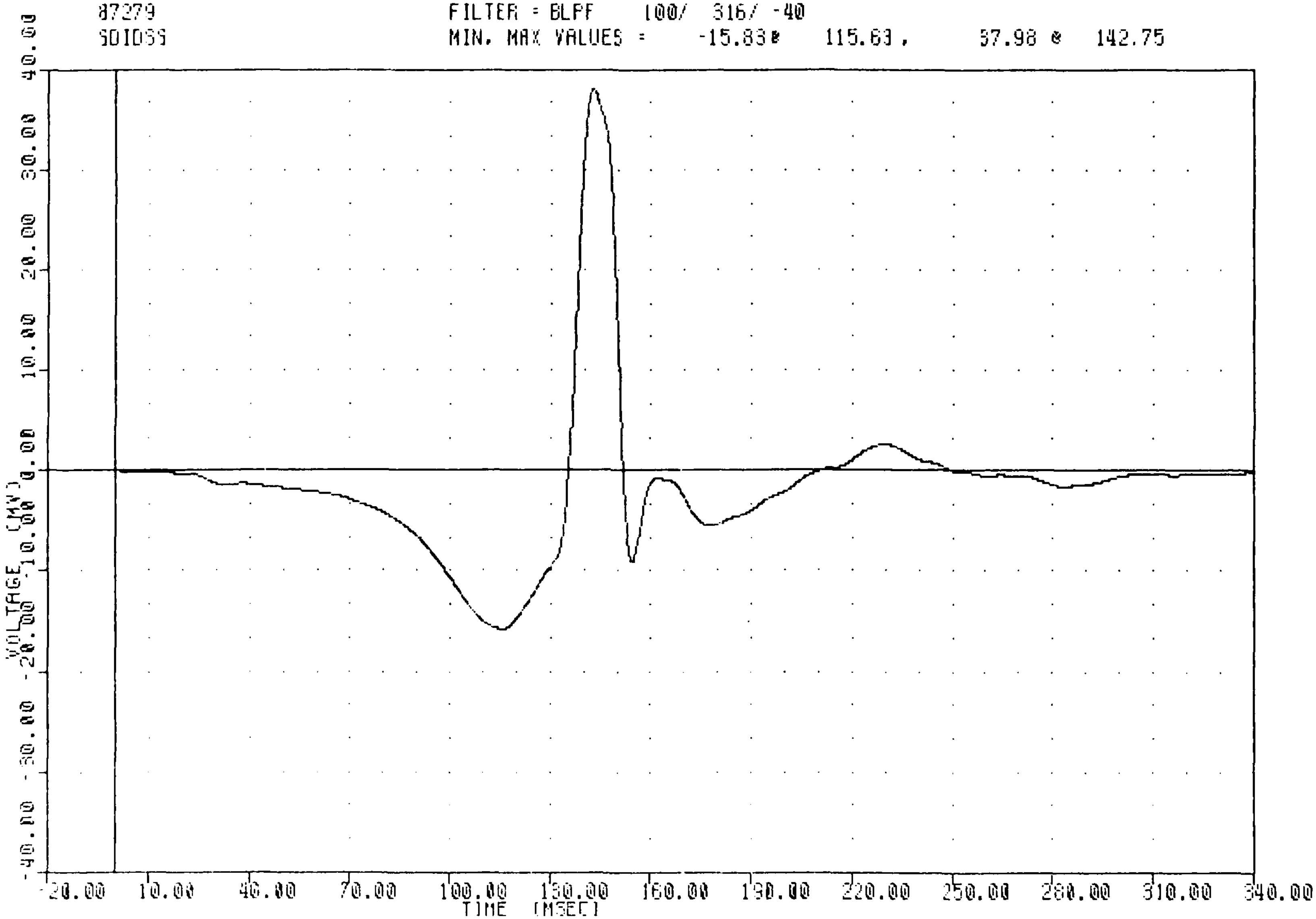
TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT D OUTBOARD DIAGONAL STRUT STRAIN



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT D INBOARD FORWARD LEG STRAIN

FAA , TEST 02
CRASH SIMULATION
87279
SDIDSS

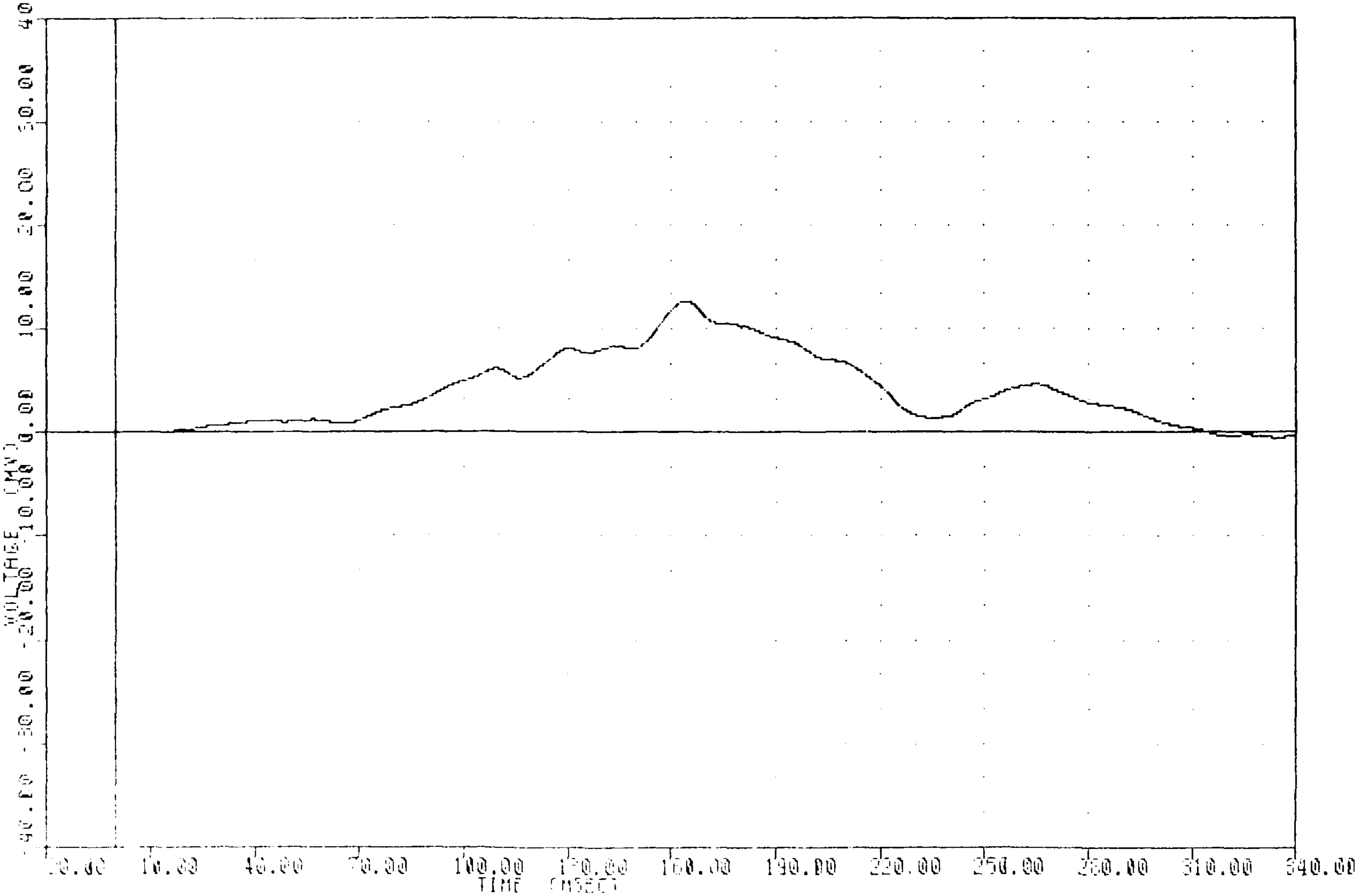
FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -15.83 @ 115.63 , 37.98 @ 142.75



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT D INBOARD DIAGONAL STRUT STRAIN

FAA , TEST 02
CRASH SIMULATION
87279
SEDFLS

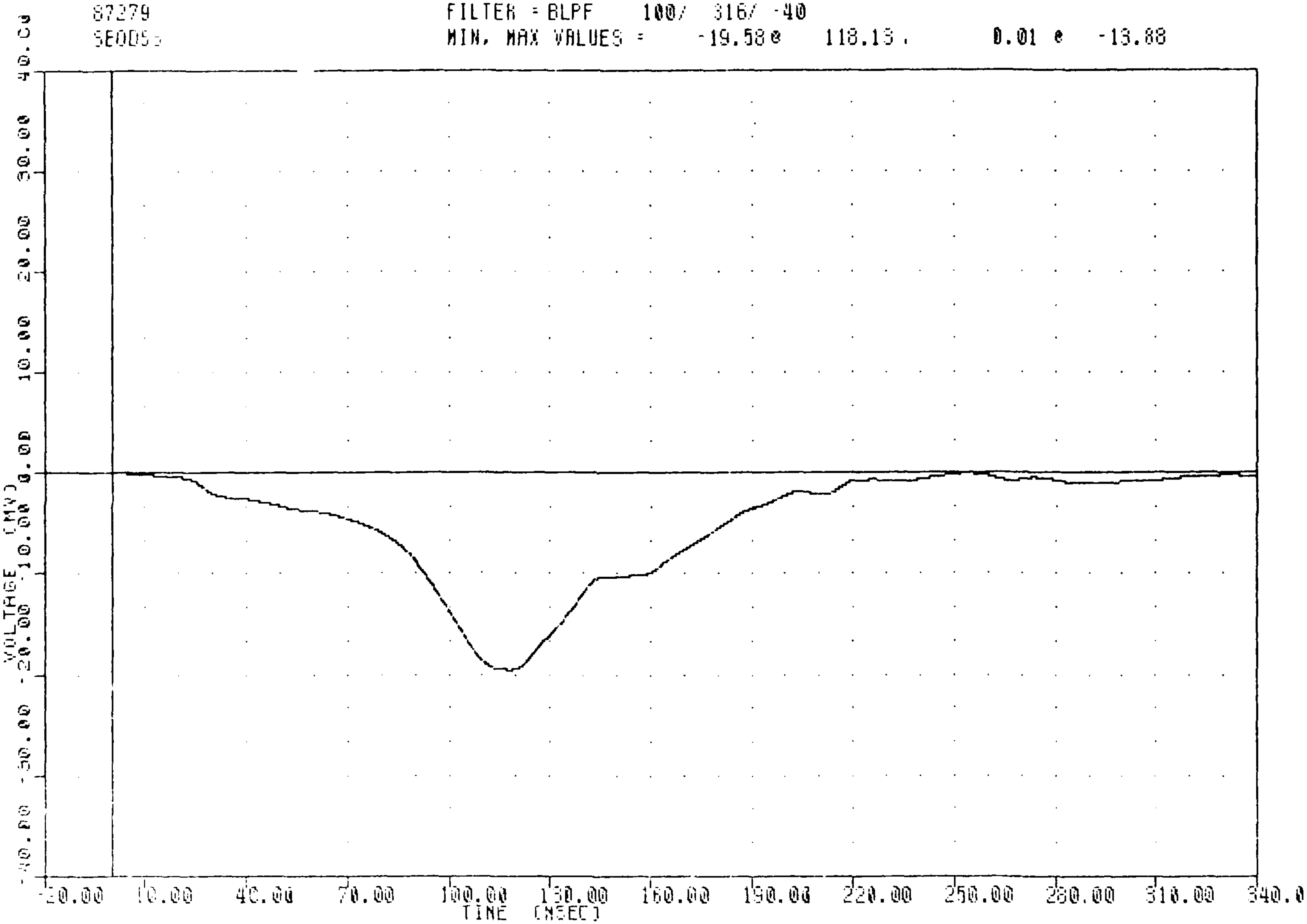
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.51@ 334.75 , 12.66 @ 164.00



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION

FAA . TEST 02
CRASH SIMULATION
87279
SEOD55

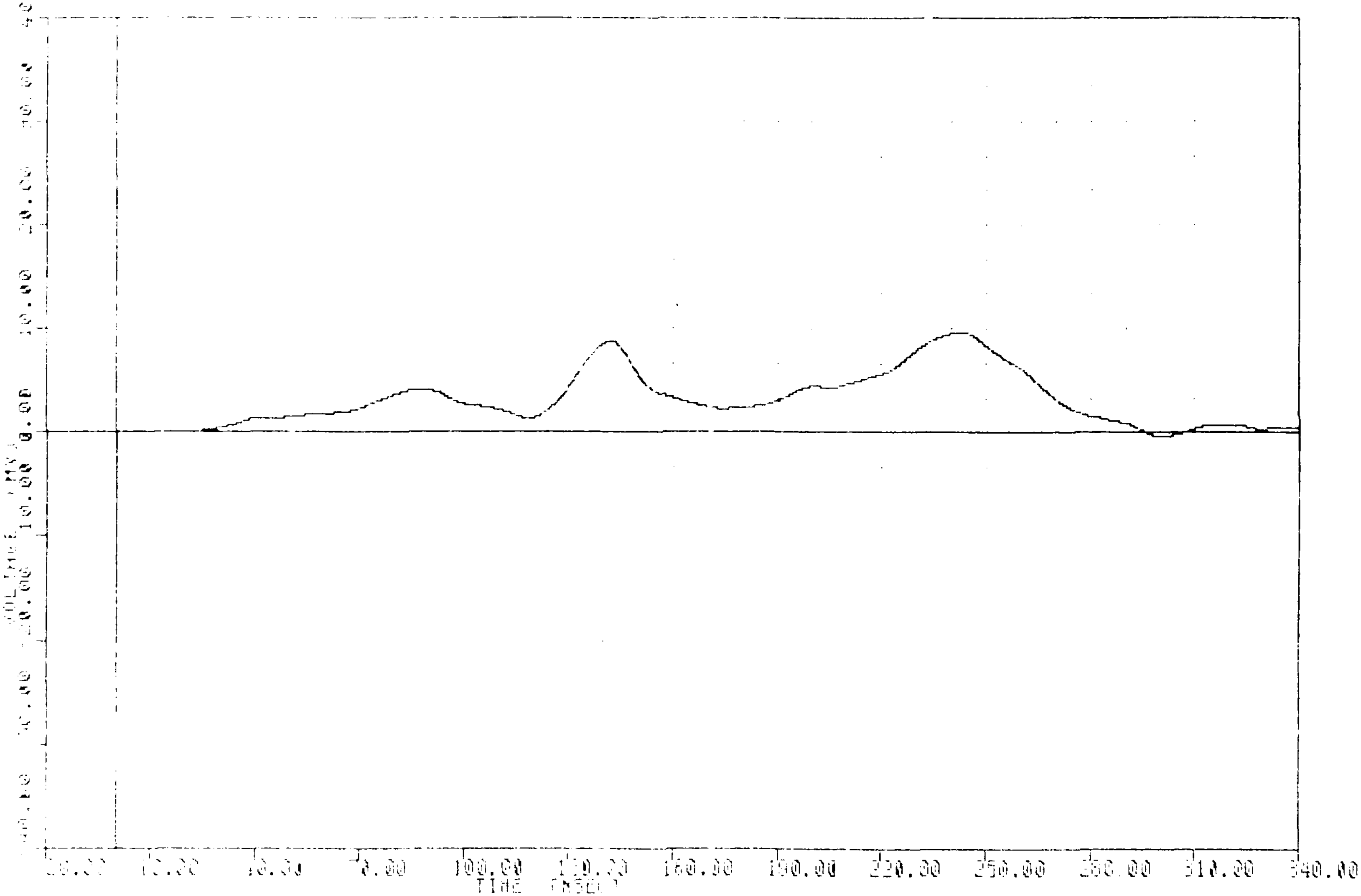
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -19.58 @ 118.13 , 0.01 @ -13.88



TRANSPORT AIRCRAFT LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION
SEAT F OUTBOARD DIAGONAL STRUT STRAIN

FAA
CRASH SIMULATION

FILTER = BLFF 100. 316/ 40
MIN, MAX VALUES = -0.40 @ 300.25 , 9.66 @ 242.63



LONGITUDINAL IMPACT SIMULATION - 14.2 G ACCELERATION

INSTRUMENTATION CALIBRATION INFORMATION

CHANNEL ABBREVIATION	INSTRUMENT MANUFACTURER	MODEL NO.	SERIAL NO.	SENSITIVITY	CALIBRATION DATE
PEVXG1	ENDEVCO	7264	CC77H	.2585mv/g	9/04/87
PEVZG1	ENDEVCO	7264	CB07H	.3482mv/g	9/10/87
PEVXG2	ENDEVCO	7264	BK96J	.2554mv/g	8/02/87
PEVZG2	ENDEVCO	7264	BY82J	.3041mv/g	8/02/87
LBOF1	LEBOW	3419	127	2.812mv/v	7/29/87
LBIF1	LEBOW	3419	236	2.704mv/v	7/29/87
LBOF2	LEBOW	3419	234	2.412mv/v	7/29/87
LBIF2	LEBOW	3419	571	0.908mv/v	6/12/87
FUSXG1	ENDEVCO	7264	CF11H	.2893mv/g	10/01/87
FUSXG2	ENDEVCO	7264	CE23H	.3607mv/g	10/01/87
FUSXG3	ENDEVCO	7264	CD74H	.3355mv/g	10/01/87
FLMXG1	ENDEVCO	7264	CE49H	.4135mv/g	10/01/87
FLAXG2	ENDEVCO	7264	CE79H	.3322mv/g	10/01/87
FLAYG2	ENDEVCO	7264	CA57H	.3183mv/g	10/01/87
FLAZG2	ENDEVCO	7264	CC01H	.2991mv/g	10/01/87
FLMXG3	ENDEVCO	7264	CE63H	.3691mv/g	9/19/87
FLMYG3	ENDEVCO	7264	CC02H	.3329mv/g	10/01/87
FLMZG3	ENDEVCO	7264	BY18J	.3267mv/g	10/01/87
FLFXG4	ENDEVCO	7264	CE72H	.3229mv/g	10/01/87
FLFYG4	ENDEVCO	7264	CE91H	.3772mv/g	9/19/87
FLFZG4	ENDEVCO	7264	CE21H	.3384mv/g	10/01/87
SECXG	ENTRAN		A1-1	.513mv/g	
SECYG	ENTRAN		A2-2	.513mv/g	
SECZG	ENTRAN		J1-1	.321mv/g	
SEDXG	ENTRAN		J3-3	.318mv/g	
SEDYG	ENTRAN		J10-1	.310mv/g	
SEDZG	ENTRAN		78-5	.335mv/g	

STATIC PULL TESTS

SETUP

On March 10 and 11, 1988 four (4) static, vertical pull tests were conducted on the B707 fuselage section. The fuselage was re-installed into the test fixture that was utilized on the two sled tests. Figures C-1 and C-2 illustrate the fuselage, the test fixture and the two I-beams that were installed through the windows. Figure C-3 illustrates how the force was applied to the seat tracks.

INSTRUMENTATION

Nine channels of data were collected during each test. The vertical displacement of the beam at body station 1180 was measured beneath each of the four seat tracks. Figures C-4 through C-9 show the displacement potentiometers. Four vertical beam strains and the applied load data were collected also.

Figure C-10 through C-17 illustrate the setup for each pull test.

On the pages following the figures are time history data plots, applied load versus beam strain data plots and applied load versus beam deflection data plots.

TEST NOTES

The Starboard Outboard Beam Strain (SOBS) strain gage output polarity appears to be opposite from the other three strain gages.

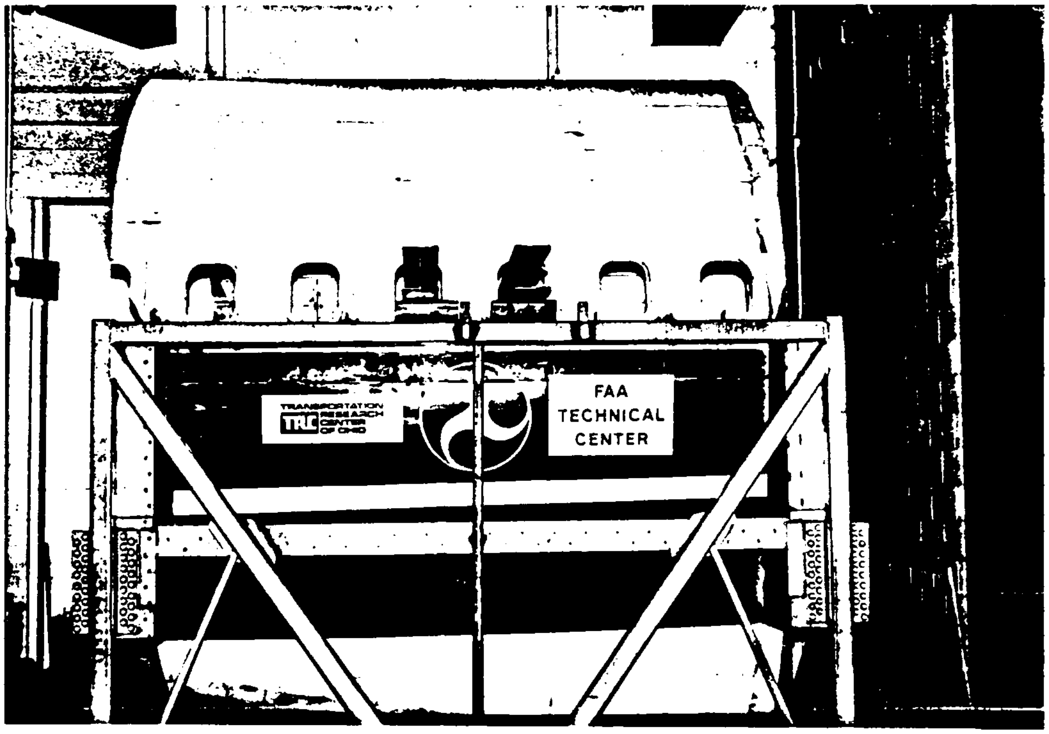


Figure C-1. FUSELAGE AND TEST FIXTURE - VIEW 1

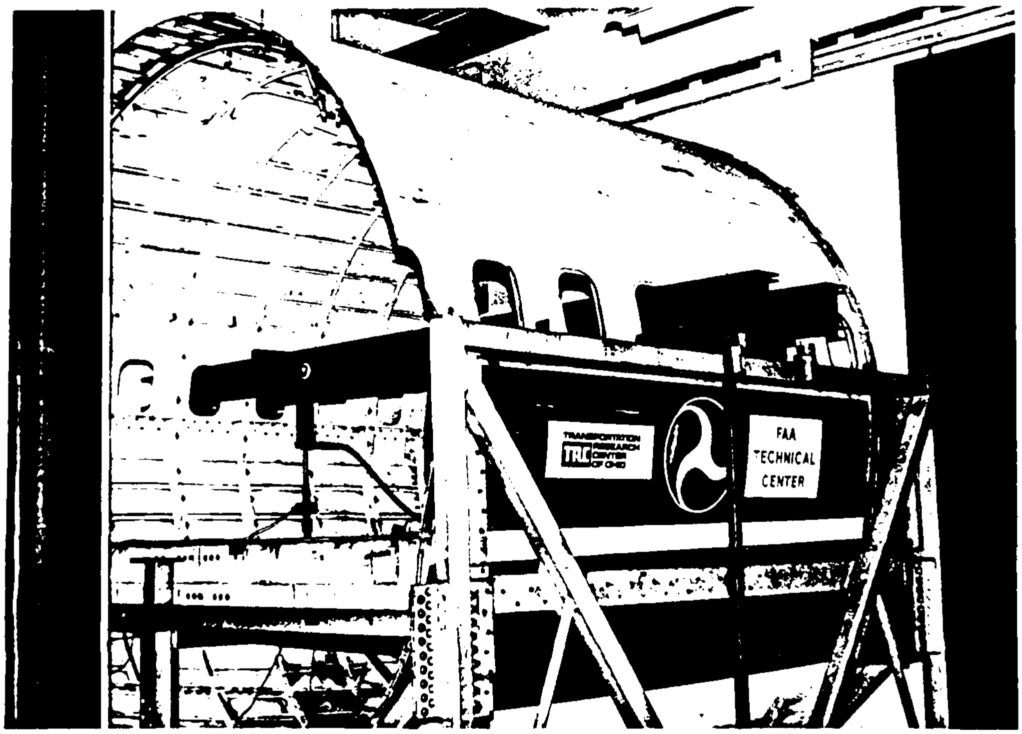


Figure C-2. FUSELAGE AND TEST FIXTURE - VIEW

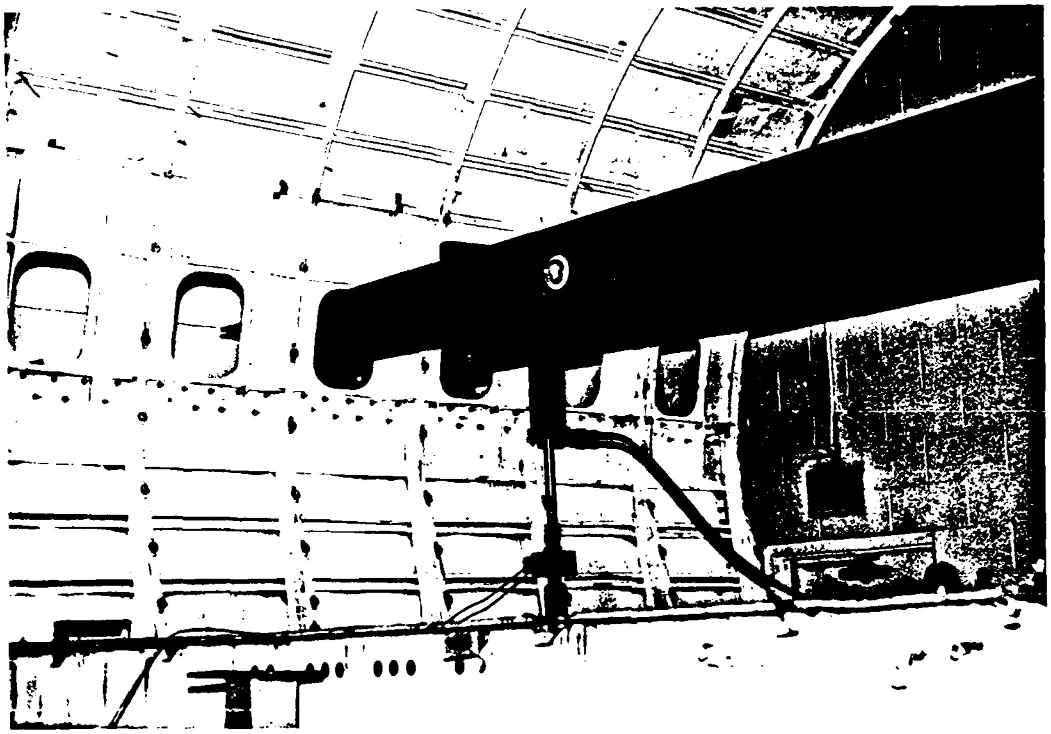
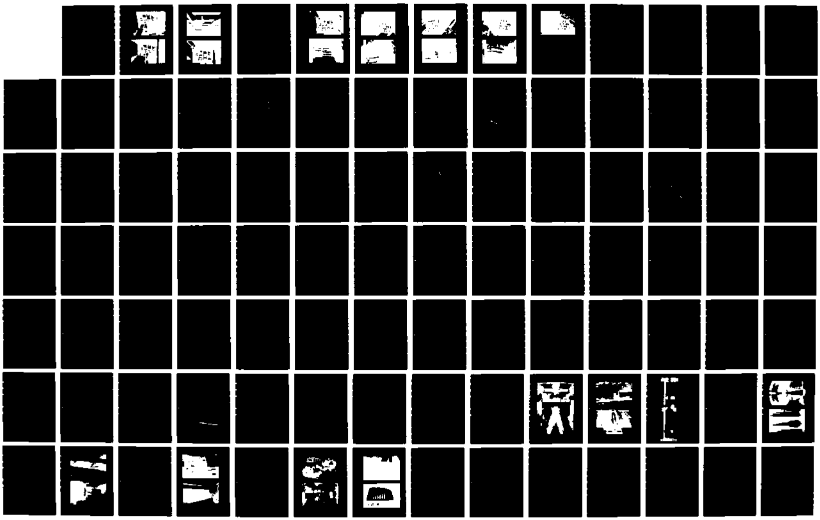
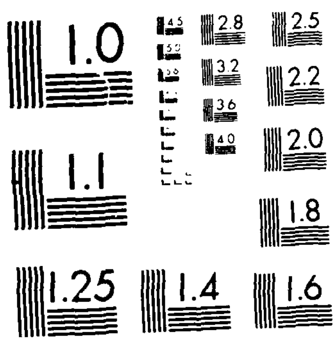


Figure C-3. LOAD APPLICATION

Figure C-4. PORT DISPLACEMENT POTENTIOMETERS

AD-A199 309 LONGITUDINAL IMPACT TEST OF A TRANSPORT AIRFRAME 3/4
SECTION(U) FEDERAL AVIATION ADMINISTRATION TECHNICAL
CENTER ATLANTIC CIT.. R JOHNSON ET AL. JUL 88
UNCLASSIFIED DOT/FAA/CT-87/26 DTFA03-87-C-00013 F/G 1/3 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

Figure C-5. PORT OUTBOARD DISPLACEMENT POTENTIOMETERS

Figure C-6. PORT INBOARD DISPLACEMENT POTENTIOMETER

Figure C-7. STARBOARD DISPLACEMENT POTENTIOMETERS

Figure C-8. STARBOARD INBOARD DISPLACEMENT POTENTIOMETERS

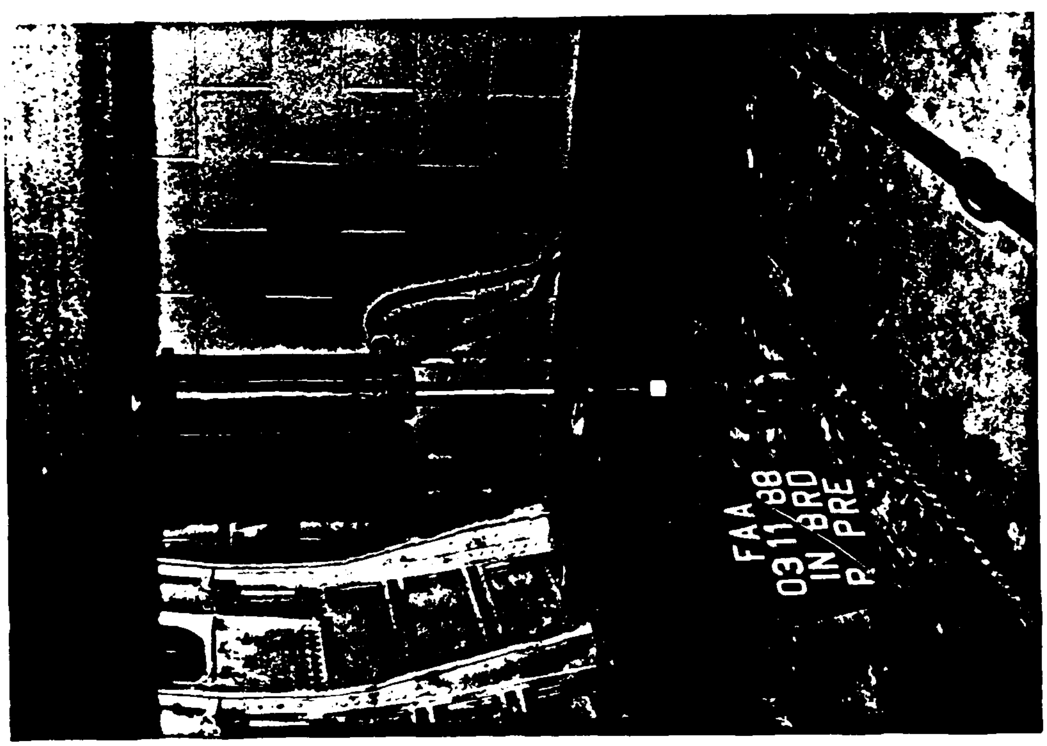
APPENDIX C

CALIBRATION DATA

Figure C-9. STARBOARD OUTBOARD DISPLACEMENT POTENTIOMETER

Figure C-10. PORT OUTBOARD TEST SETUP

Figure C-11. [illegible] OUTBOARD TEST SETUP - [illegible]



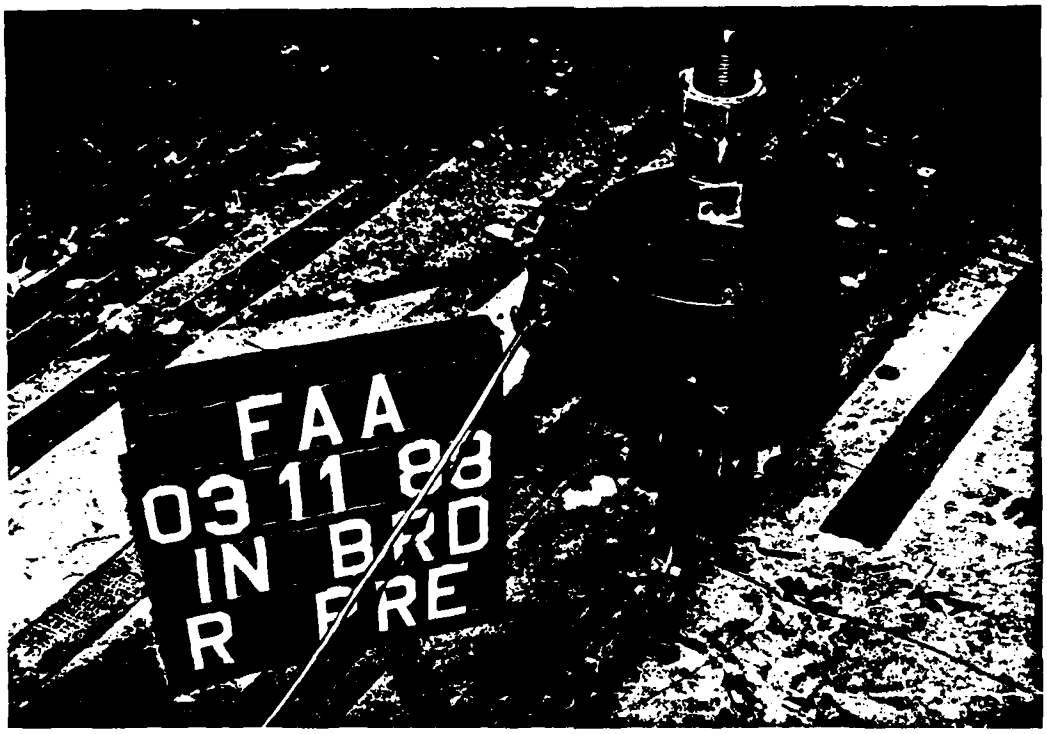


Figure C-13. PORT INBOARD TEST SETUP - CLOSEUP

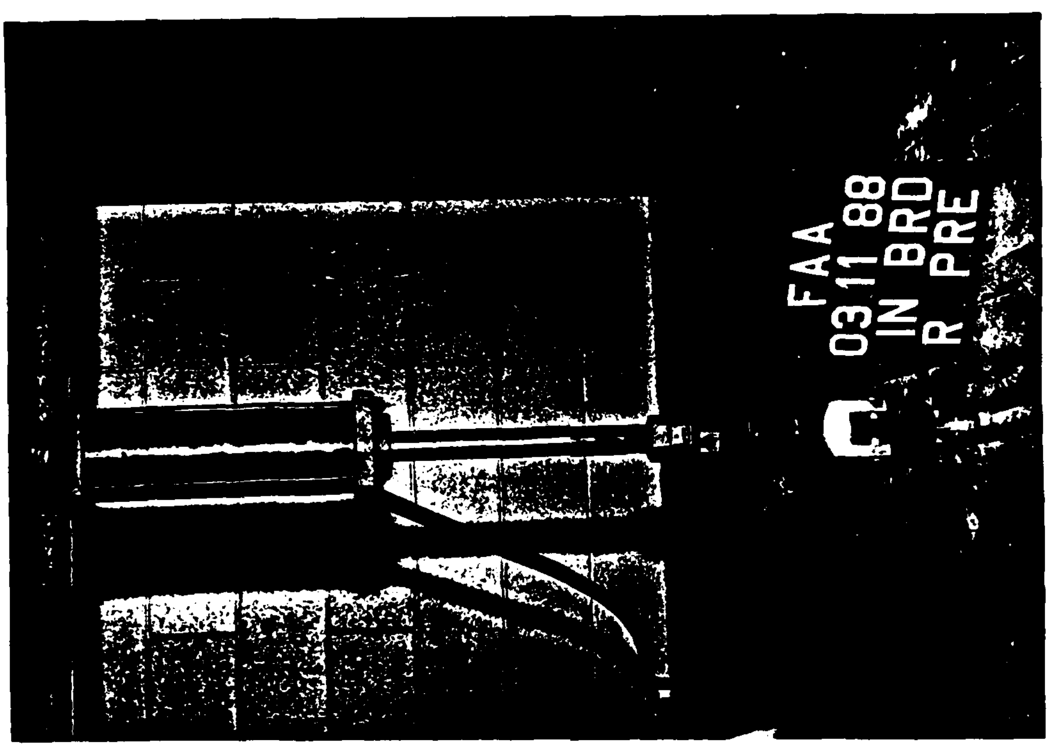


Figure C-14. STARBOARD INBOARD TEST SETUP

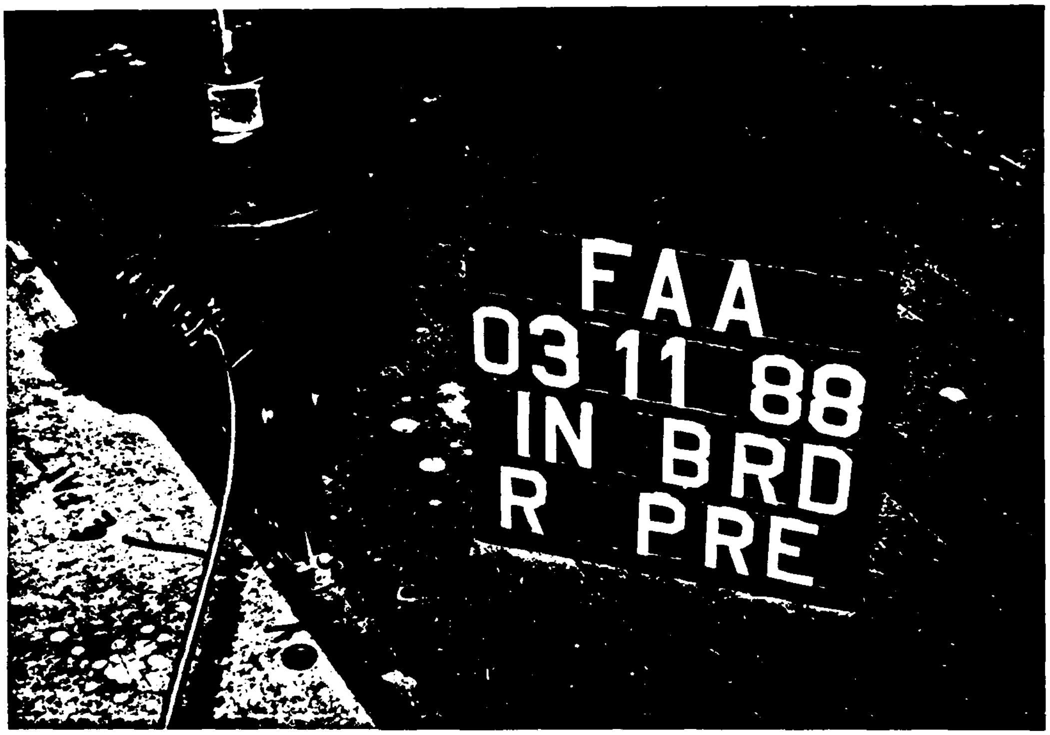
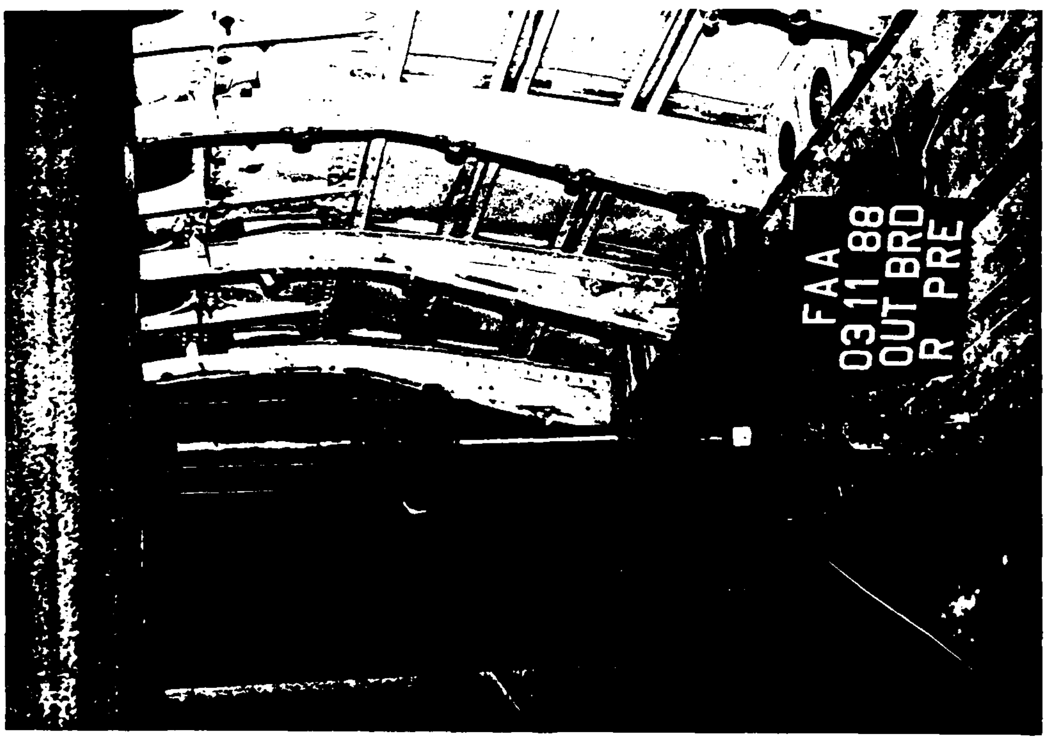
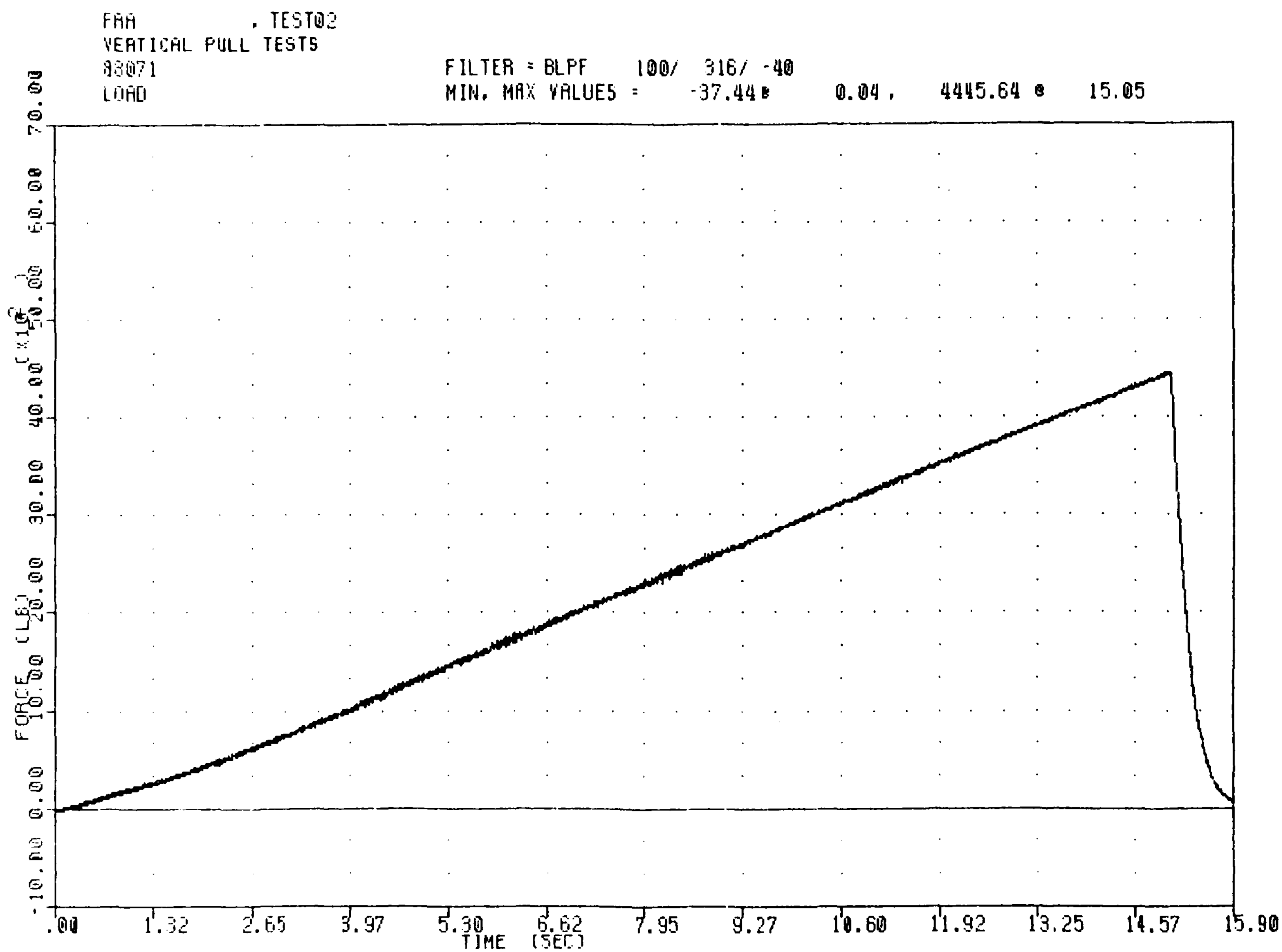


Figure C-15. STARBOARD INBOARD TEST SETUP - CLOSEUP

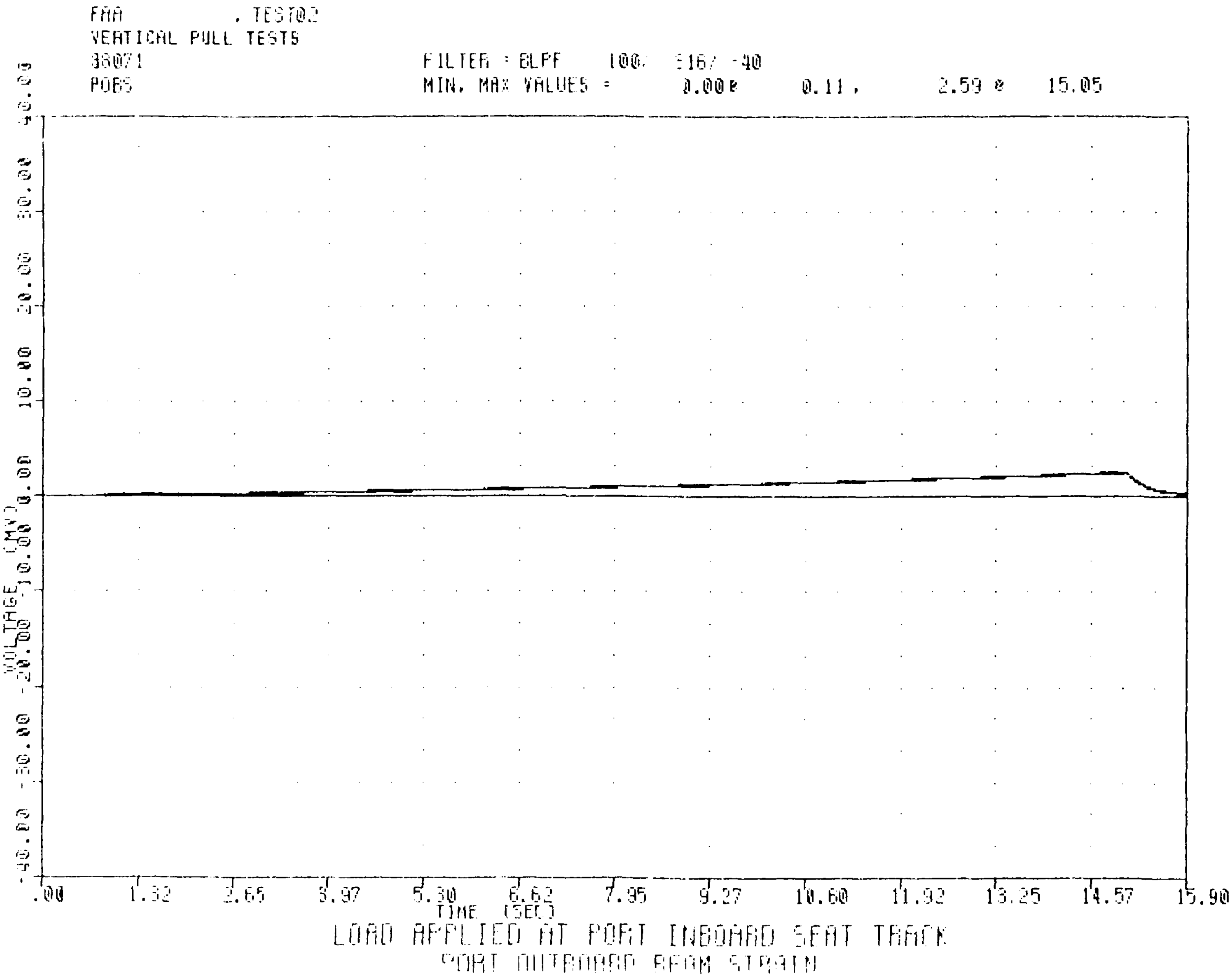


[illegible]

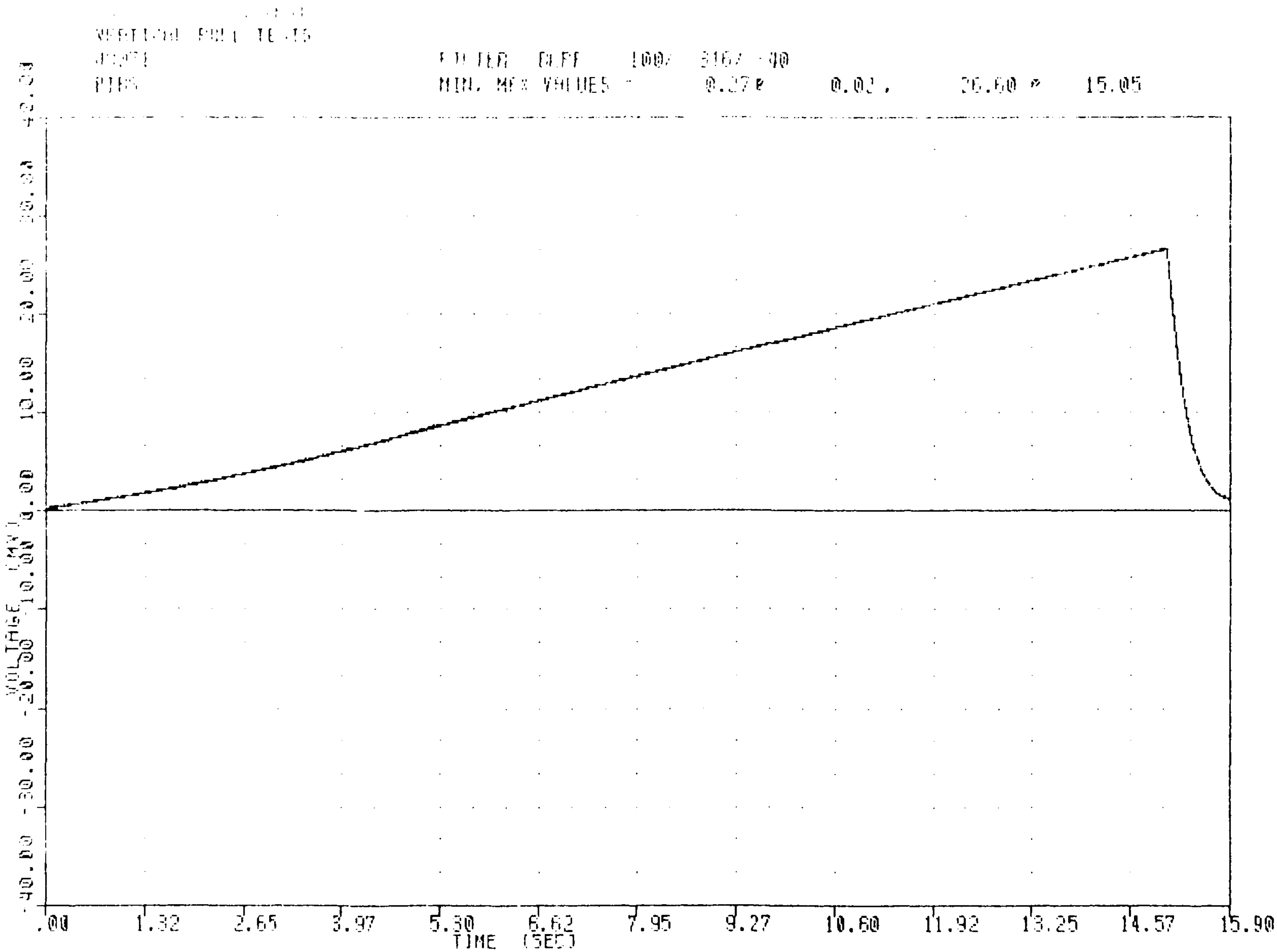
Figure C-17. STARBOARD OUTBOARD TEST SETUP - CLOSEUP



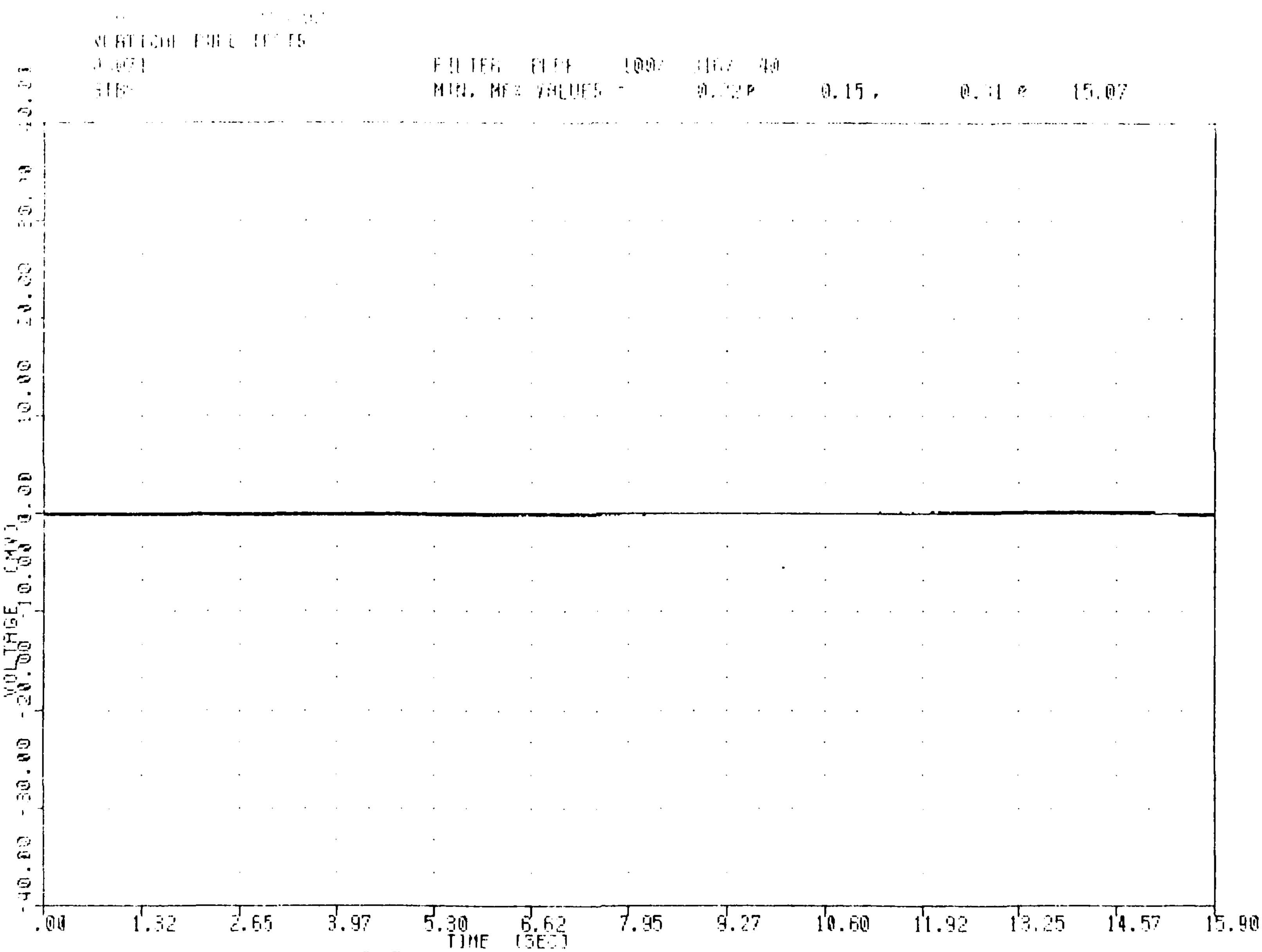
LOAD APPLIED AT PORT INBOARD SEAT TRACK
LOAD APPLIED TO SEAT TRACK



FAA , TEST02
VERTICAL PULL TESTS
38071
P085
FILTER : BLPF 100/ 316/ -40
MIN, MAX VALUES = 0.00 @ 0.11 , 2.59 @ 15.05
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
VOLTAGE (MV)
.00
1.32
2.65
3.97
5.30
6.62
7.95
9.27
10.60
11.92
13.25
14.57
15.90
TIME (SEC)
LOAD APPLIED AT PORT INBOARD SEAT TRACK
PORT OUTBOARD BEAM STRAIN



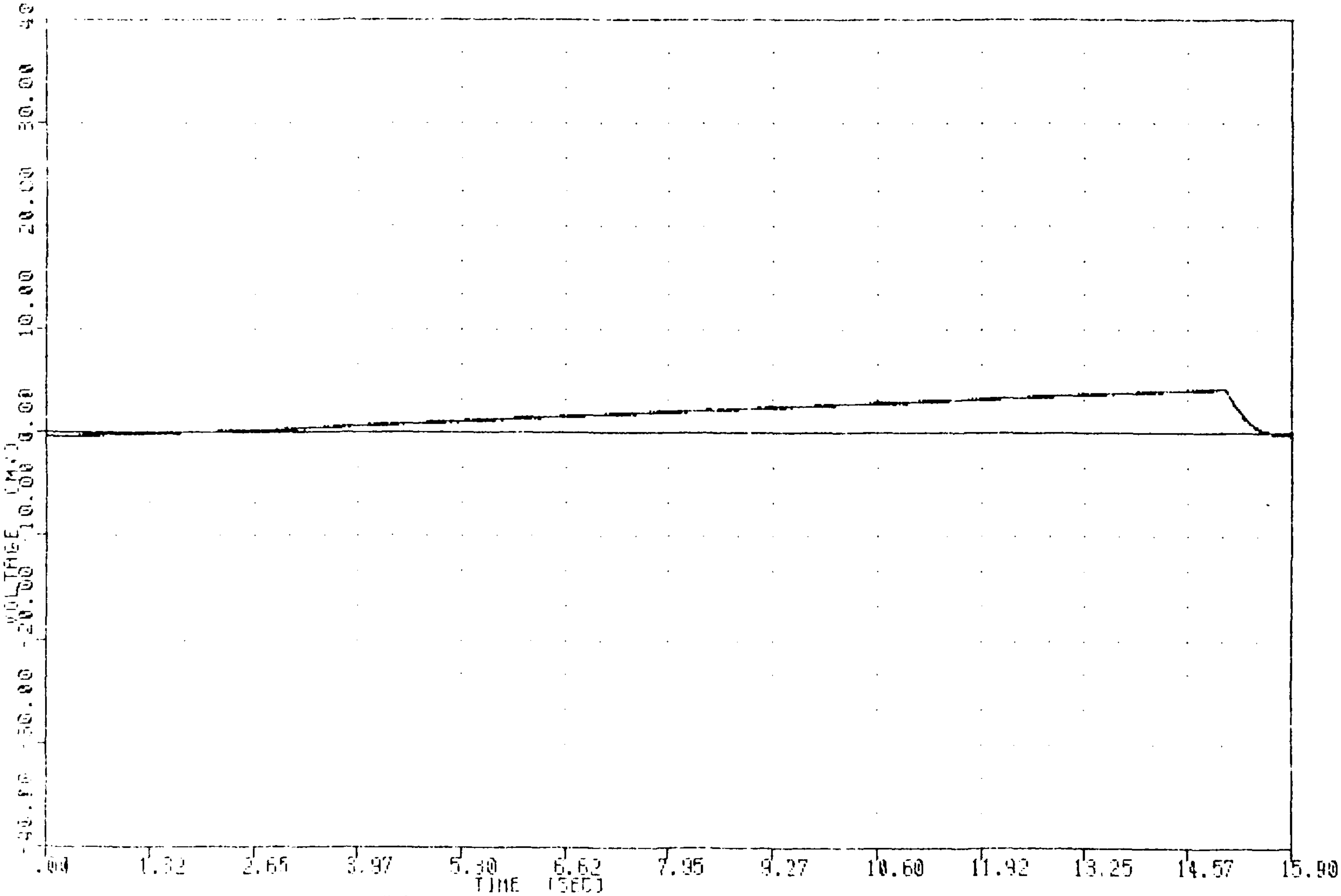
LOAD APPLIED AT PORT INBOARD SEAT TRACK
PORT INBOARD BEAM STRAIN



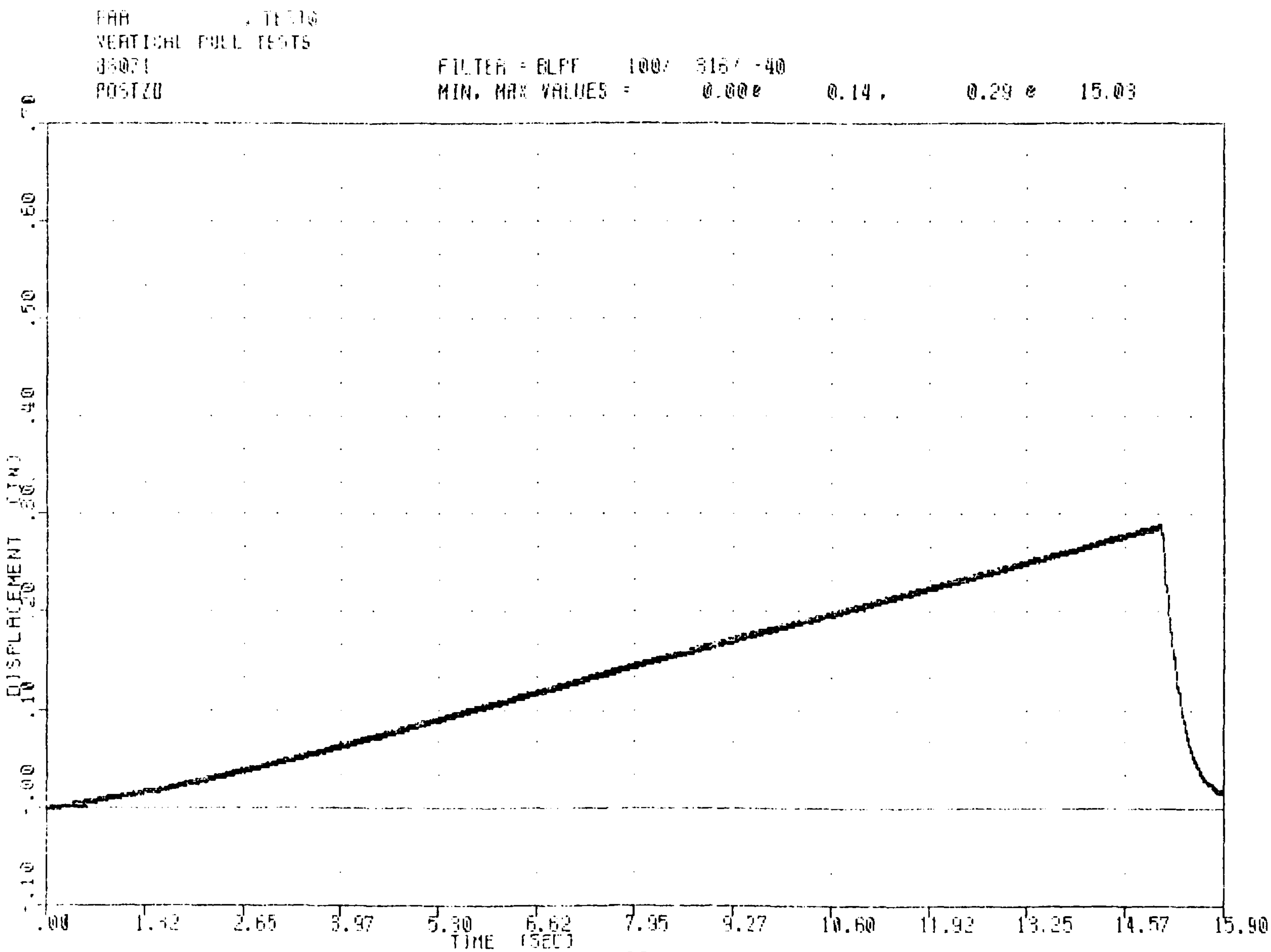
LOAD APPLIED AT PORT INBOARD SEAT TRACK
STARBOARD INBOARD BEAM STRAIN

VERTICAL PULL TESTS

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.41 @ 0.04, 4.33 @ 15.02



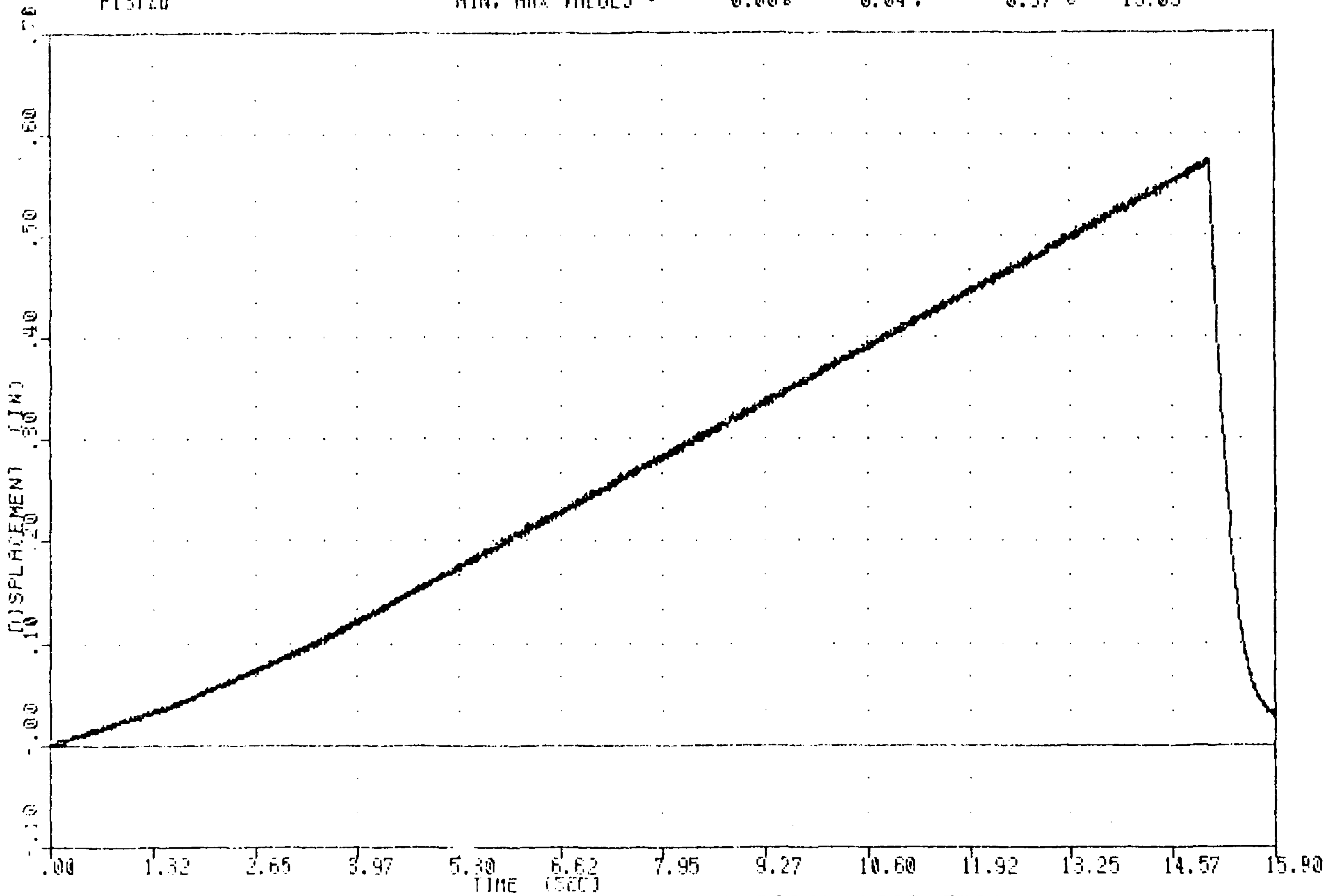
LOAD APPLIED AT PORT INBOARD SEAT TRACK



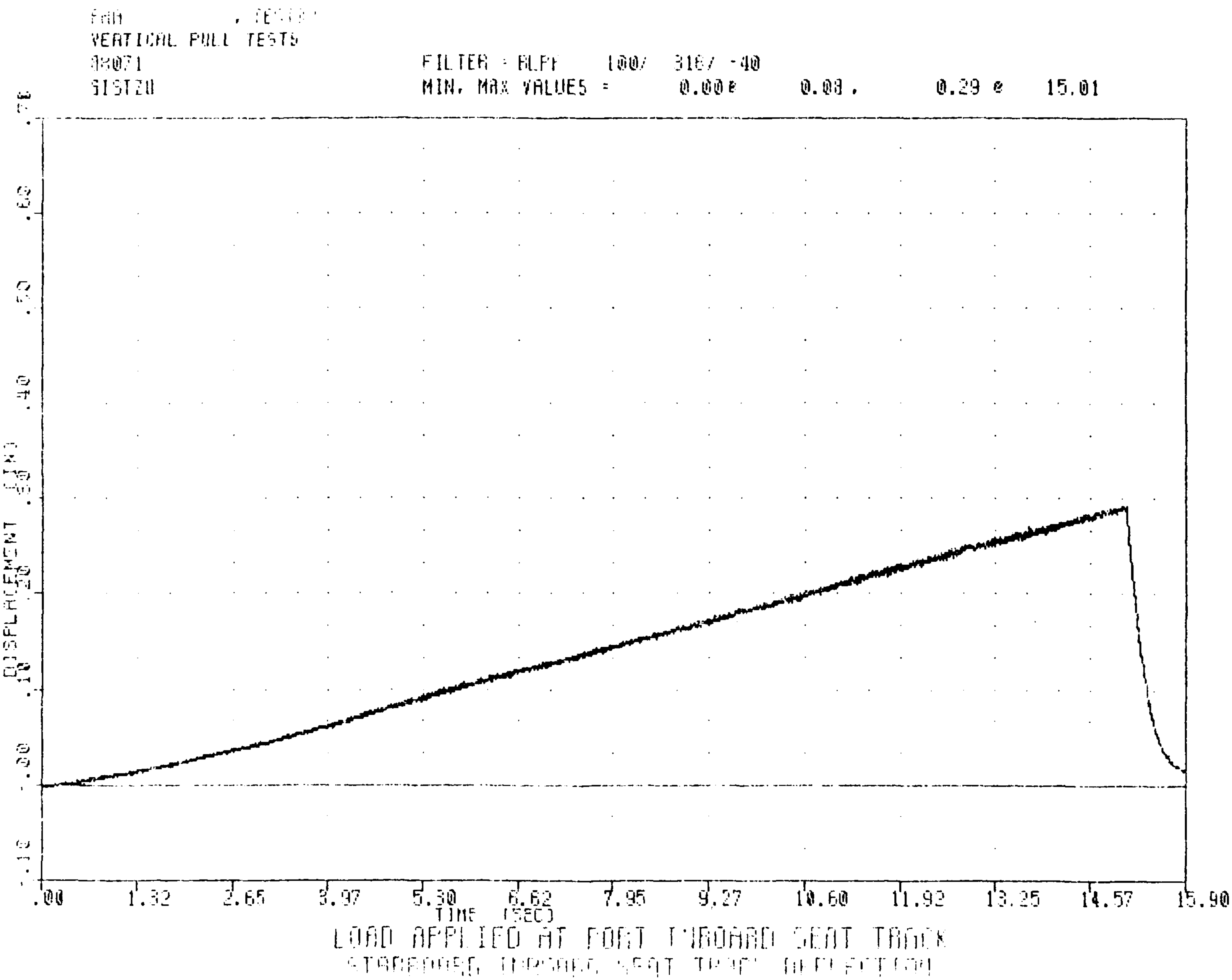
LOAD APPLIED AT PORT INBOARD SEAT TRACK

IAH , TEST02
VERTICAL PULL TESTS
88071
PISTZD

FILTER : CLPF 100/ 316/ -40
MIN, MAX VALUES = 0.00 @ 0.04 , 0.57 @ 15.03

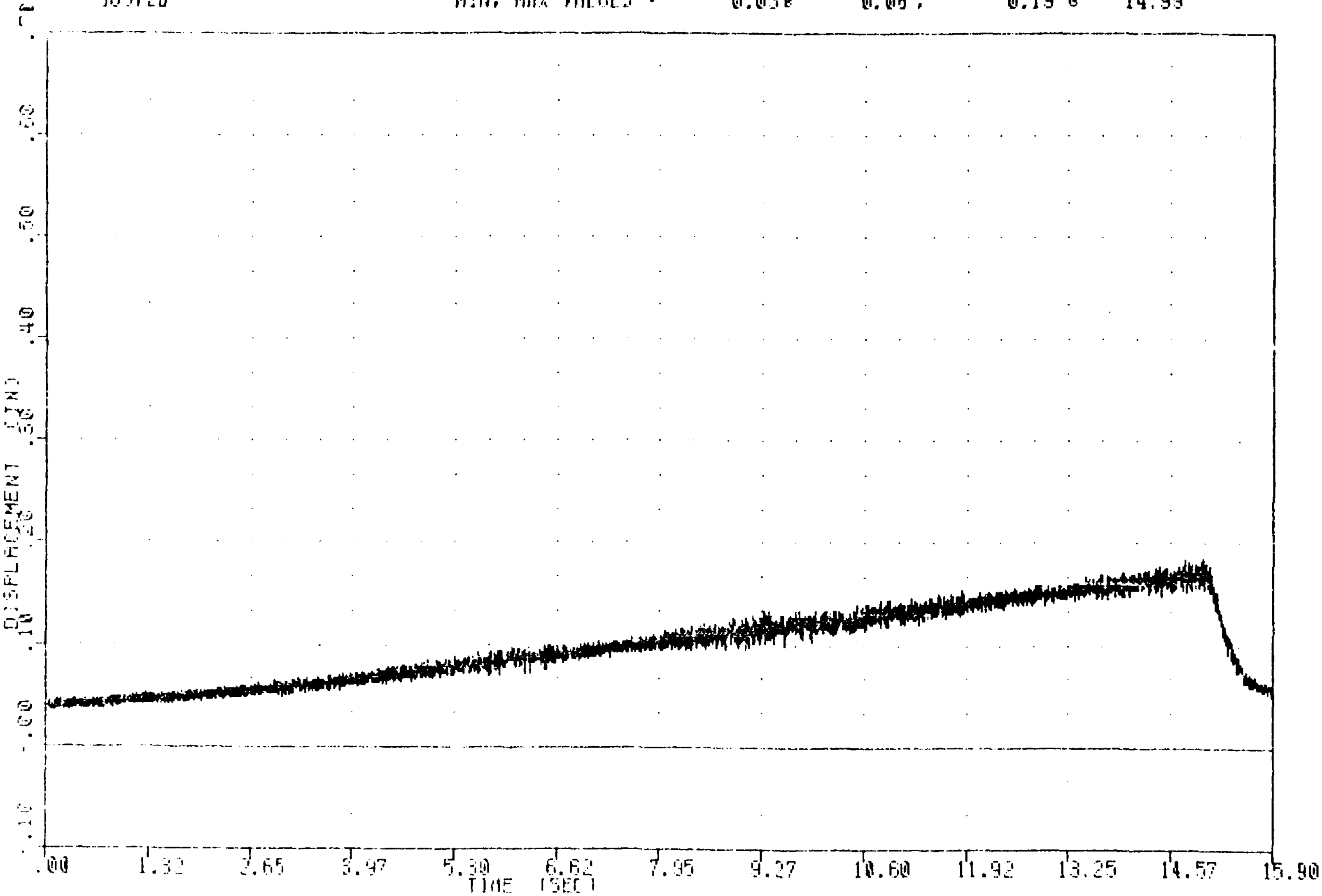


LOAD APPLIED AT PORT INBOARD SEAT TRACK
PORT INBOARD SEAT TRACK DEFLECTION


FAA , TEST
VERTICAL PULL TESTS
38071
5IST20
FILTER : BLPF 100/ 310/ -40
MIN, MAX VALUES = 0.00@ 0.08 , 0.29 @ 15.01
DISPLACEMENT (IN)
.70
.60
.50
.40
.30
.20
.10
.00
-.10
.00
1.32
2.65
3.97
5.30
6.62
7.95
9.27
10.60
11.92
13.25
14.57
15.90
TIME (SEC)
LOAD APPLIED AT PORT INBOARD SEAT TRACK

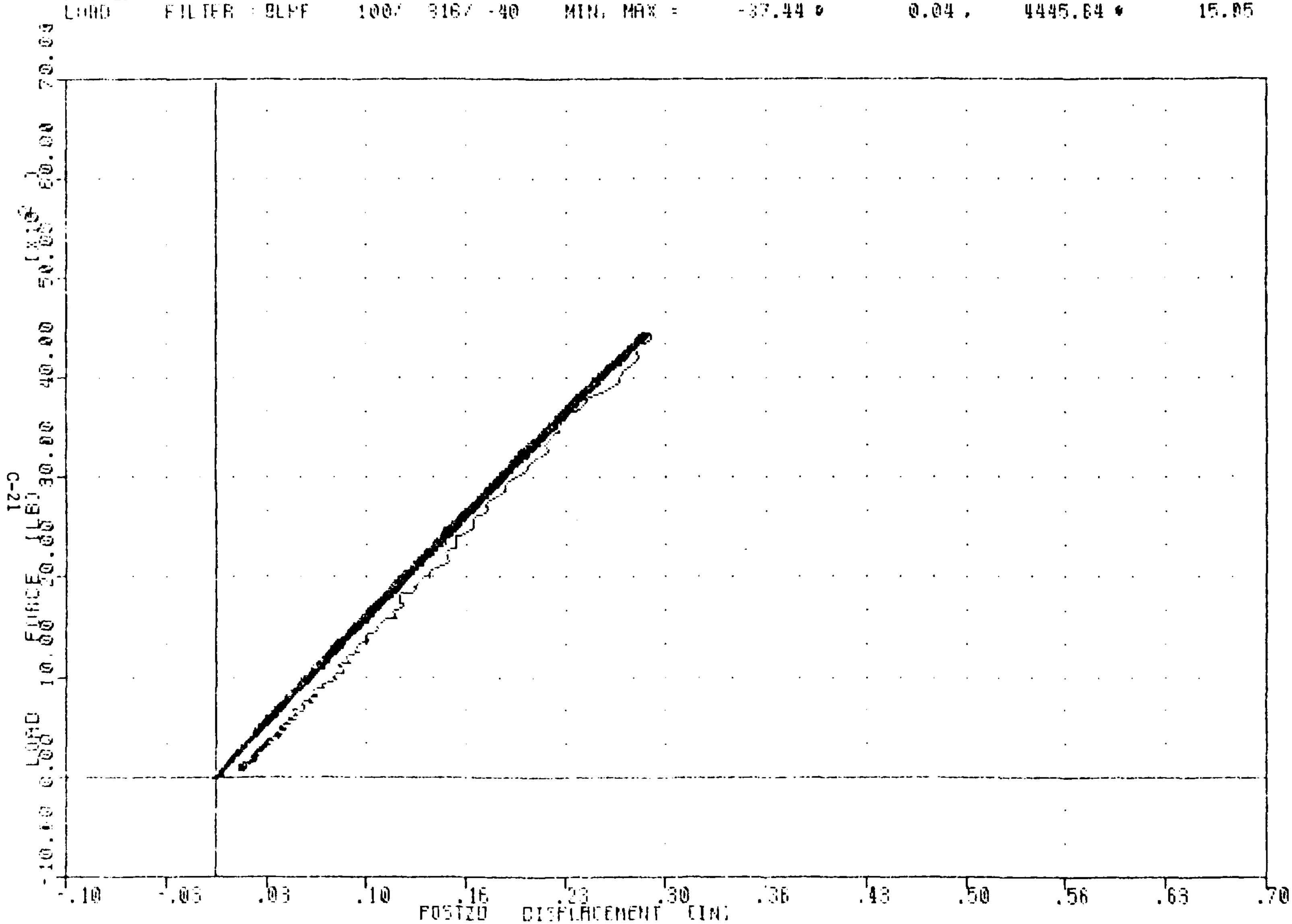
FAA , TEST02
VERTICAL PULL TESTS
85071
505TZ0

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = 0.03 @ 0.06 , 0.19 @ 14.99



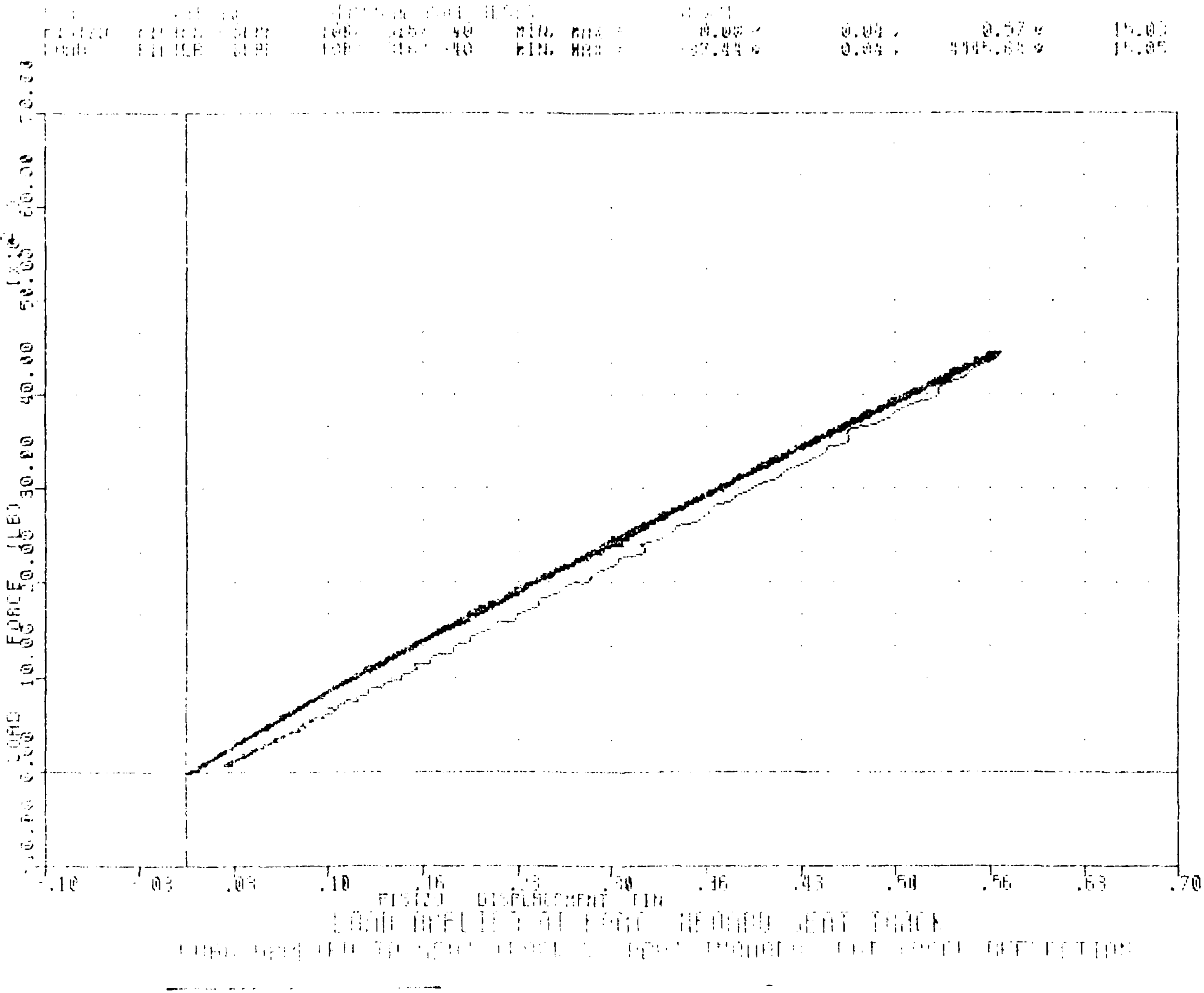
LOAD APPLIED AT PORT INBOARD SEAT TRACK
STARBOARD OUTBOARD SEAT TRACK DEFLECTION

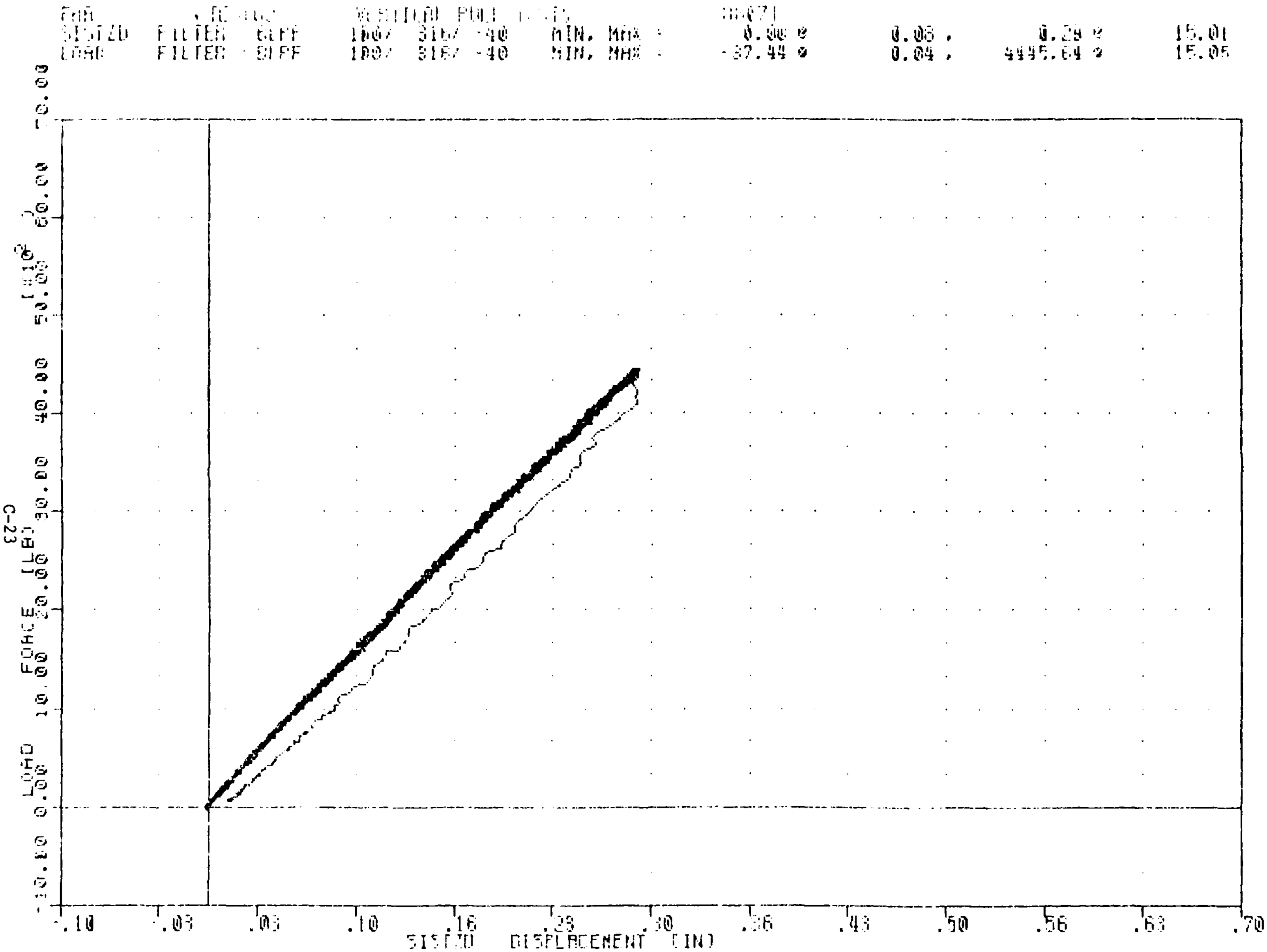
```
LAB       ...TEST02     VERTICAL PULL TESTS           A8071
POSTZD    FILTER = BLPF  100/ 316/ -40  MIN, MAX =     0.00 @    0.14 ,     0.29 @    15.03
LOAD      FILTER = BLPF  100/ 316/ -40  MIN, MAX =   -37.44 @    0.04 ,  4445.64 @    15.05
```



LOAD APPLIED AT PORT INBOARD SEAT TRACK

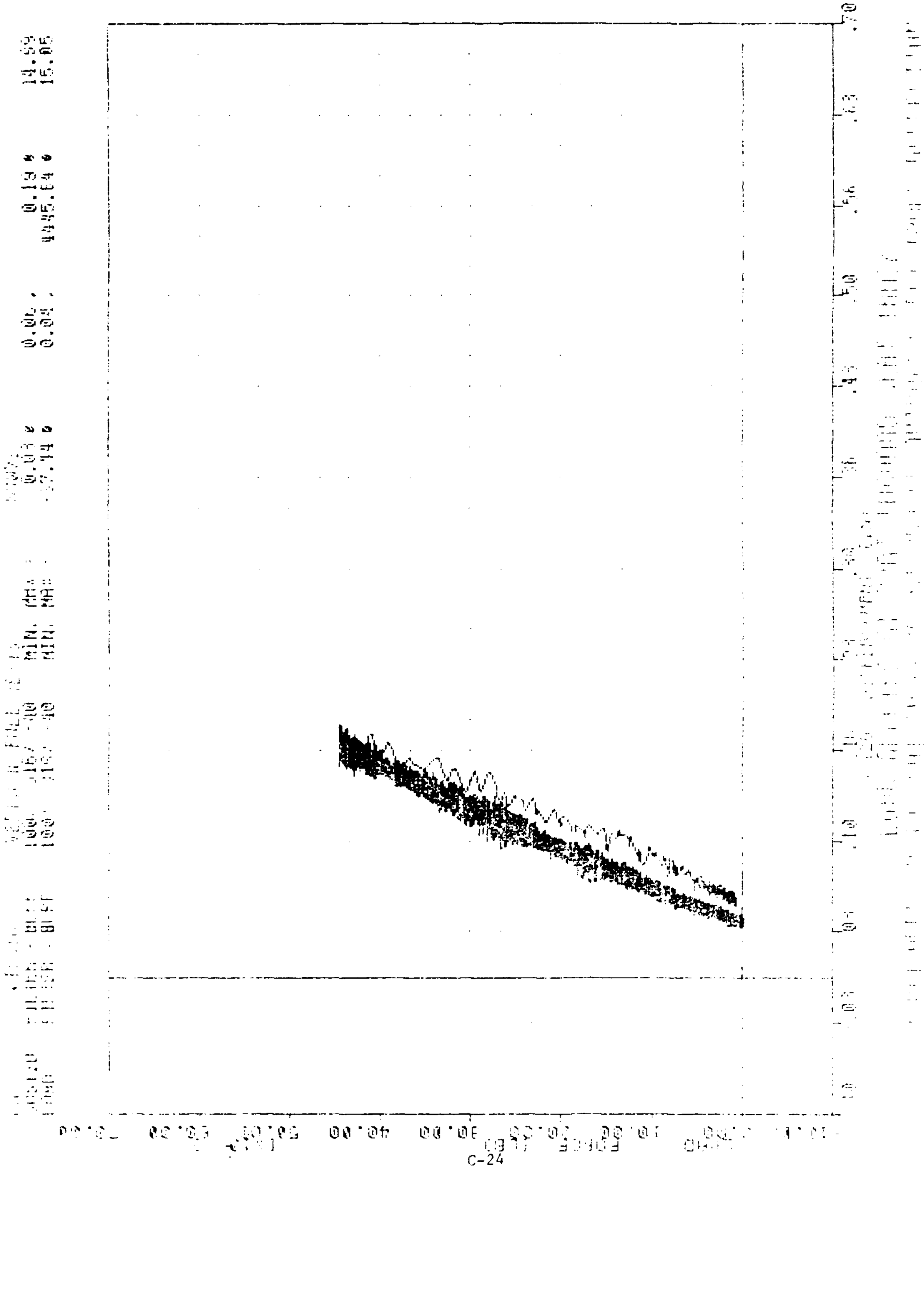
LOAD APPLIED TO SEAT TRACK VS PORT OUTBOARD SEAT TRACK DEFLECTION

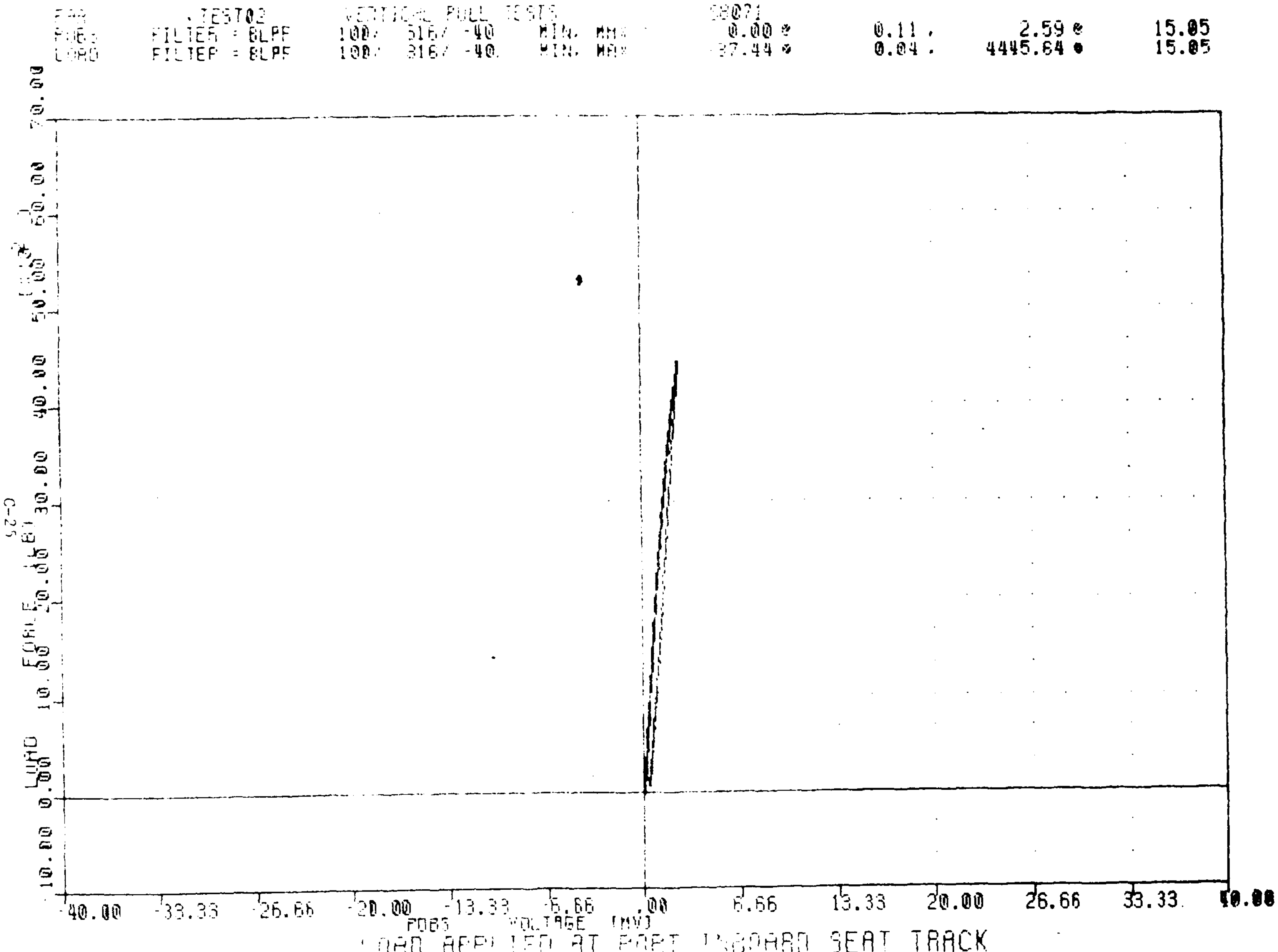

LOAD FORCE (LB)
DISPLACEMENT (IN)
-10.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
-.10
-.03
.03
.10
.16
.23
.30
.36
.43
.50
.56
.63
.70



LOAD APPLIED AT PORT INBOARD SEAT TRACK

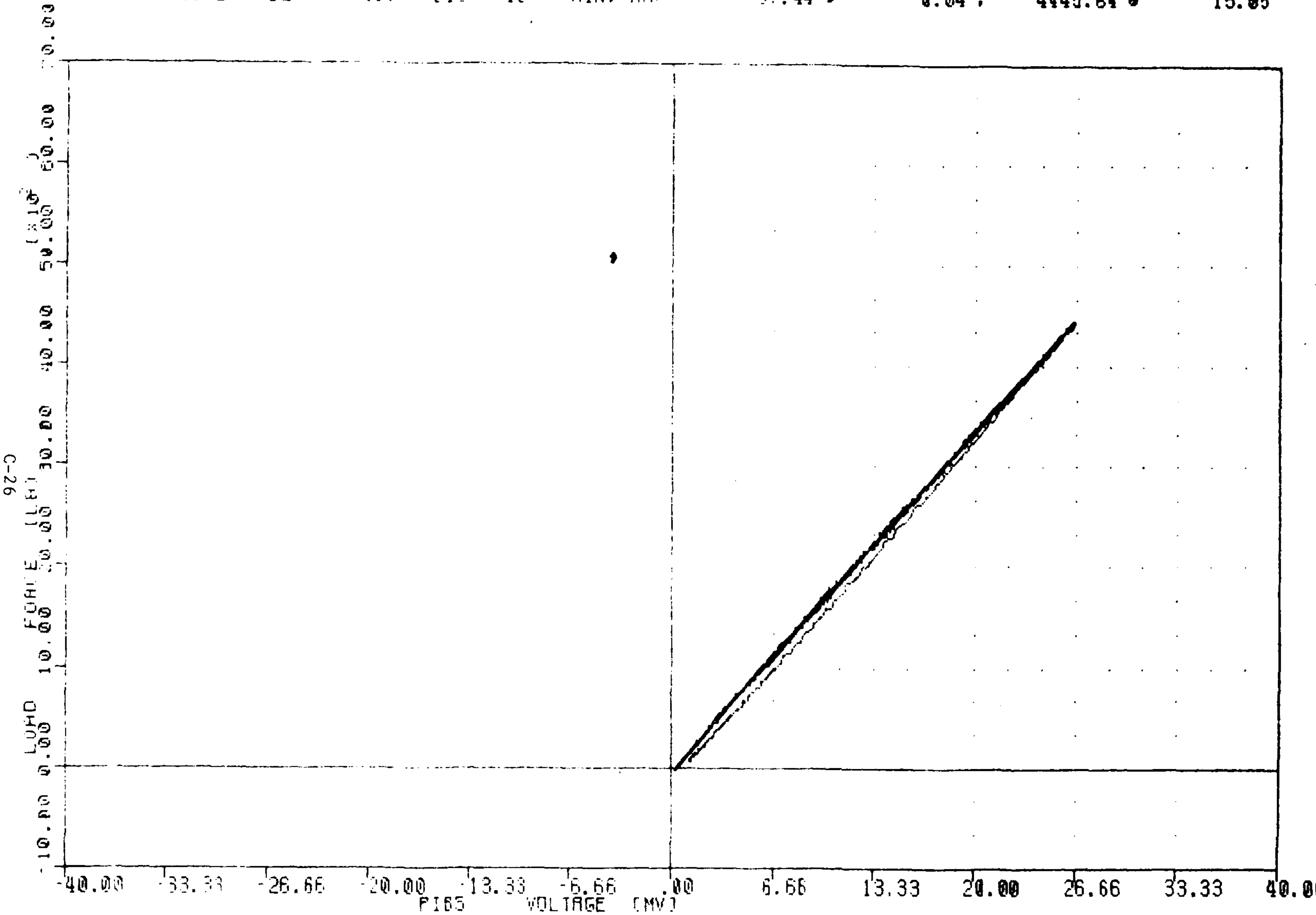
LOAD APPLIED TO SEAT TRACK VS STARBOARD INBOARD SEAT TRACK DEFLECTION





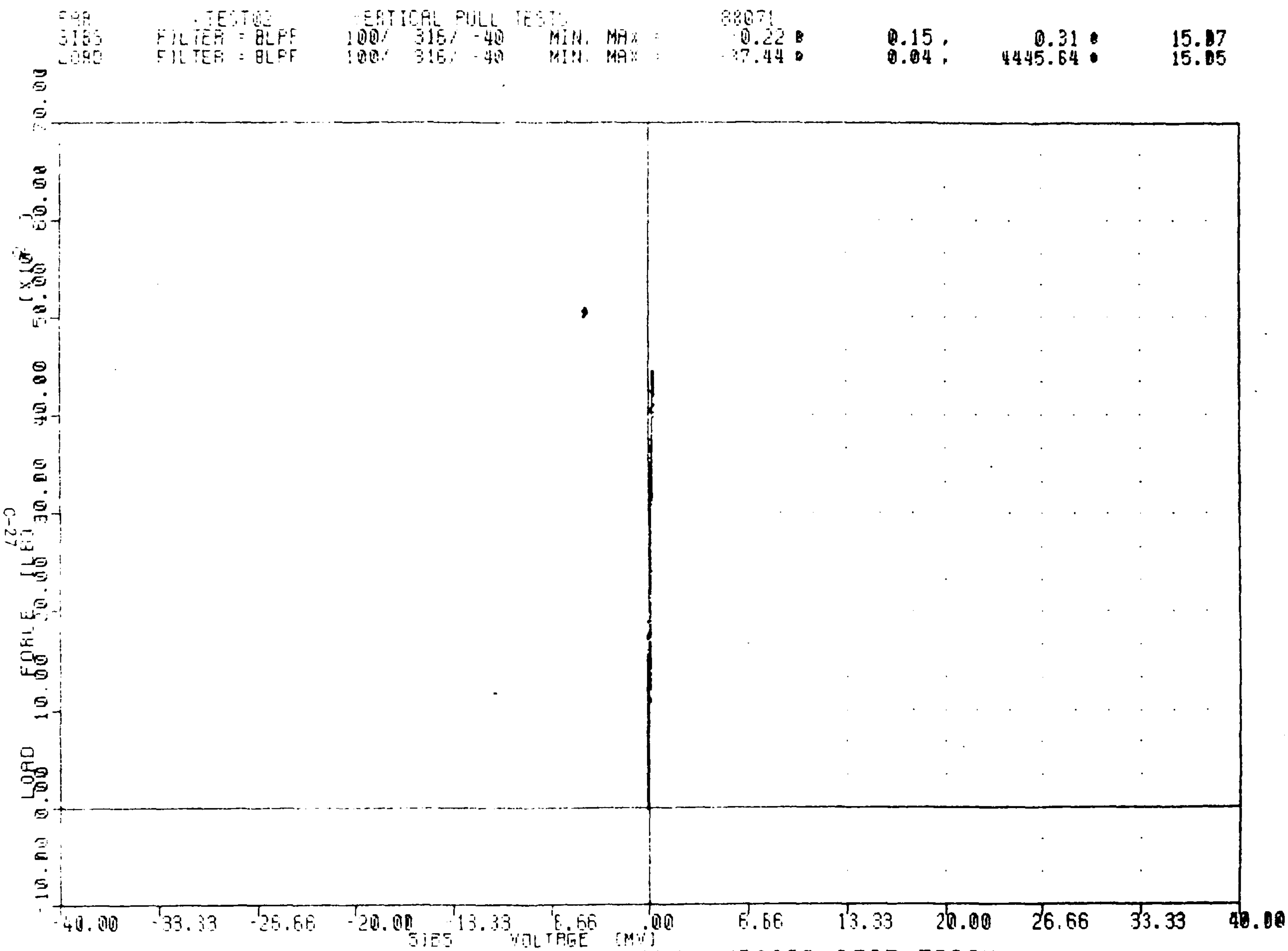
LOAD APPLIED TO SEAT TRACK VS PORT OUTBOARD BEAM STRAIN

FA- ,TEST02 VERTICAL PULL TESTS 88071
FIBS FILTER BLPF 100/ 316/ 40 MIN. MAX 0.27 @ 0.02 , 26.60 @ 15.05
LOAD FILTER BLPF 100/ 316/ 40 MIN. MAX -37.44 @ 0.04 , 4445.64 @ 15.05



LOAD APPLIED AT PORT INBOARD SEAT TRACK

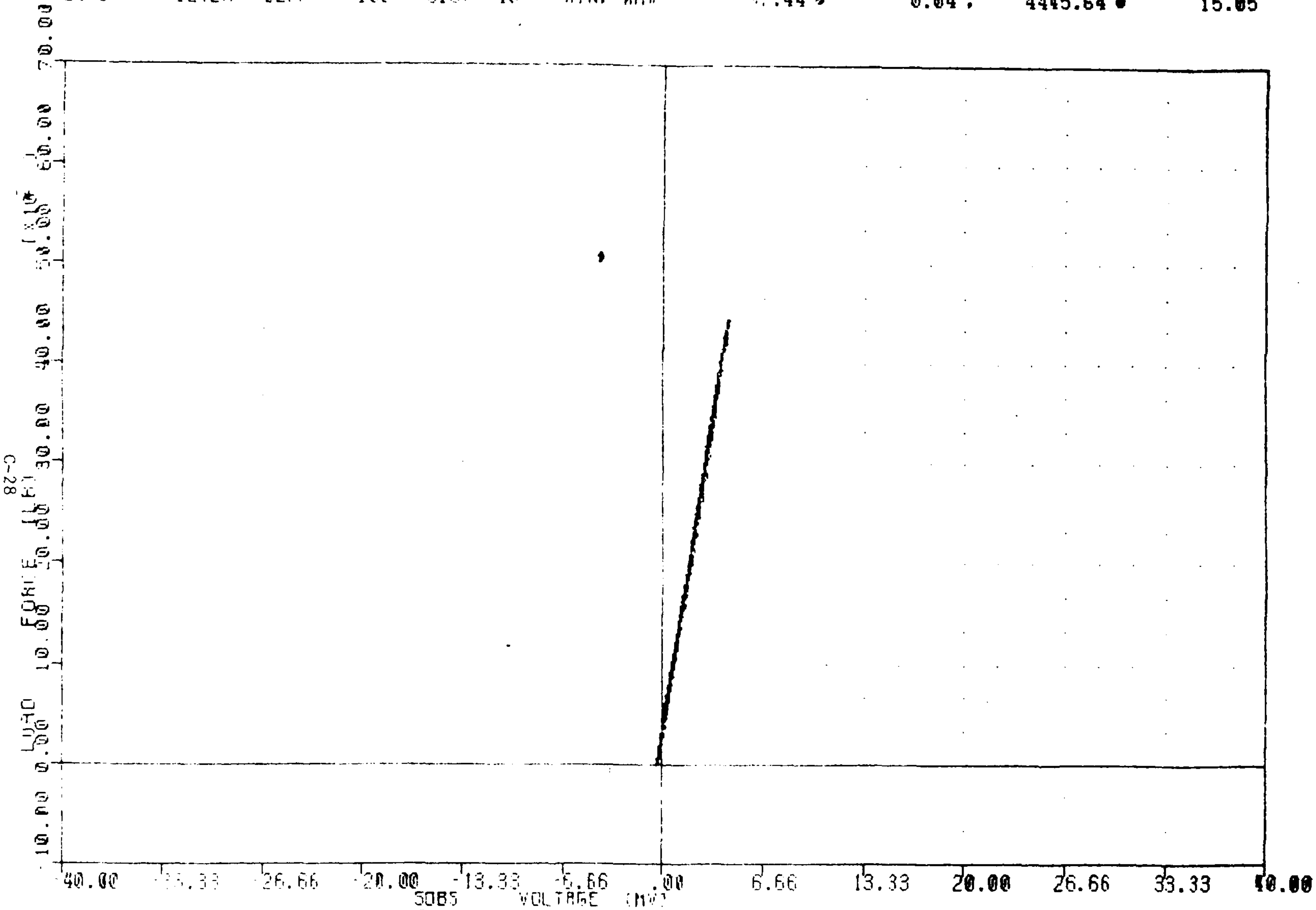
LOAD APPLIED TO SEAT TRACK VS PORT INBOARD BEAM STRAIN



LOAD APPLIED AT PORT INBOARD SEAT TRACK

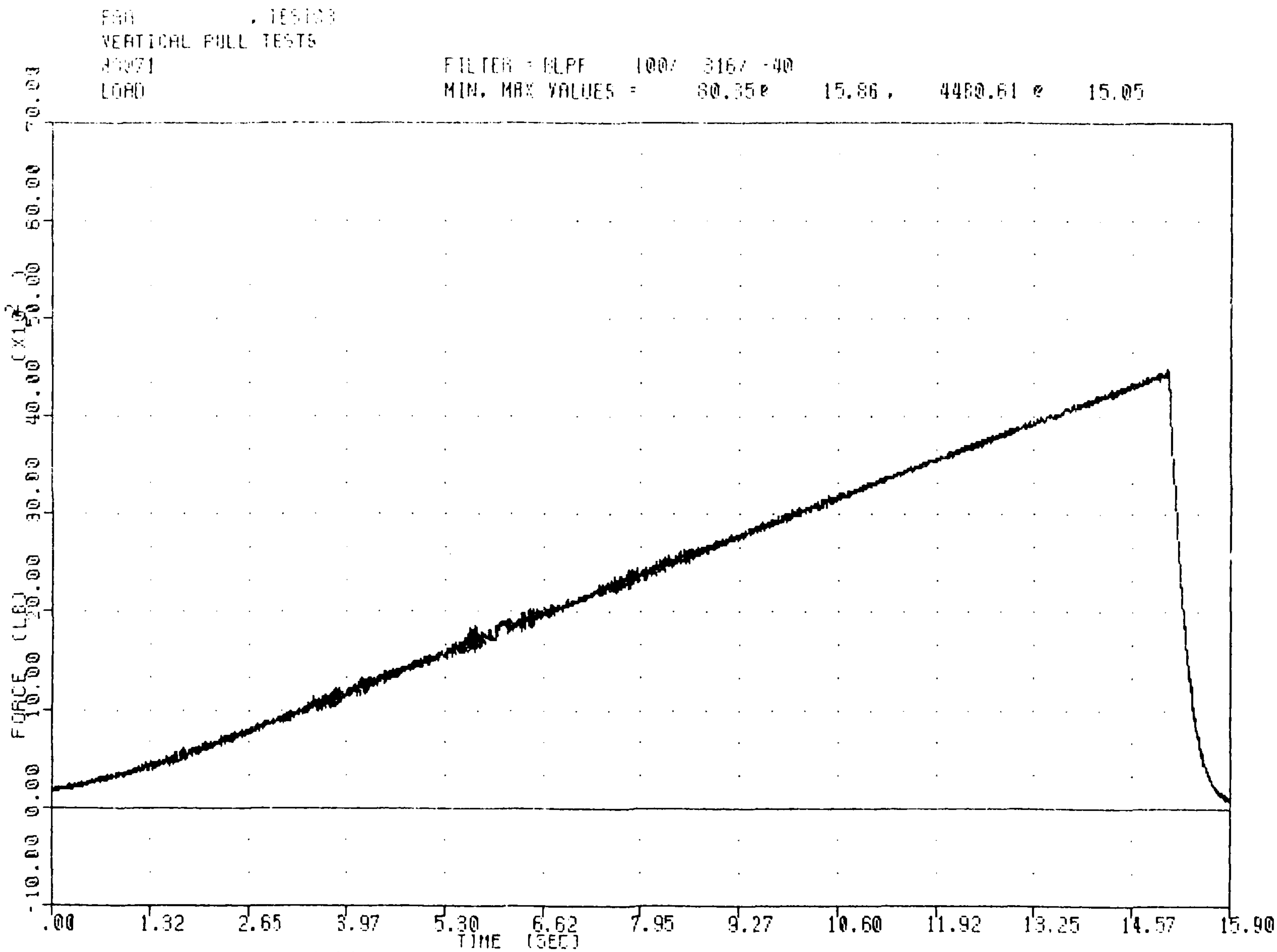
LOAD APPLIED TO SEAT TRACK VS STARBOARD INBOARD BEAM STRAIN

SAE .TEST02 VERTICAL PUL. TEST 88071
SOBS FILTER = BLPF 100/ 316/ -40 MIN, MAX = -0.41 @ 0.04 , 4.33 @ 15.02
LOAD FILTER = BLPF 100/ 316/ -40 MIN, MAX = -37.44 @ 0.04 , 4445.64 @ 15.05



LOAD APPLIED AT PORT INBOARD SEAT TRACK

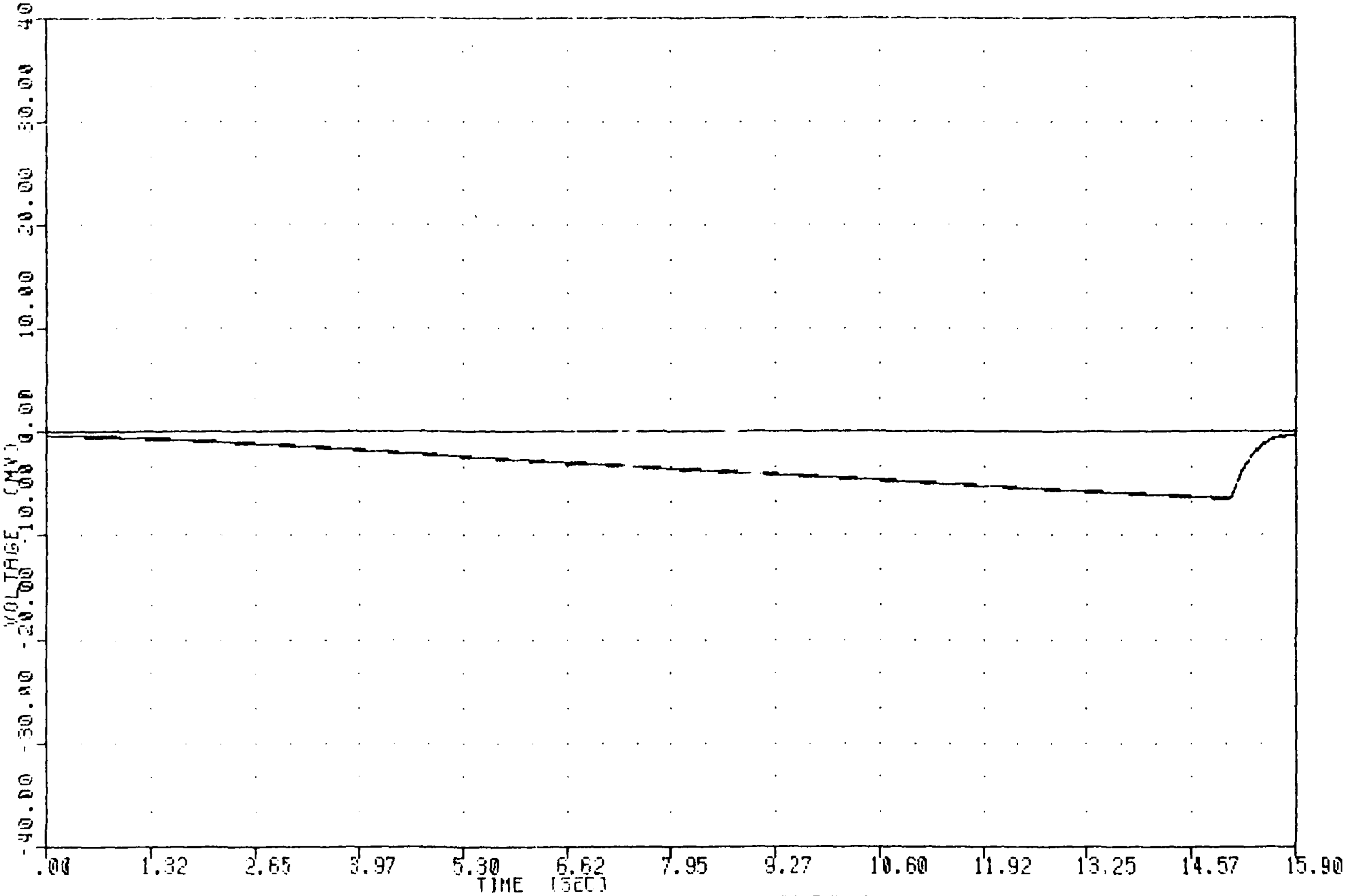
LOAD APPLIED TO SEAT TRACK VS STARBOARD OUTBOARD BEAM STRAIN



LOAD APPLIED AT STARBOARD INBOARD SEAT TRACK
LOAD APPLIED TO SEAT TRACK

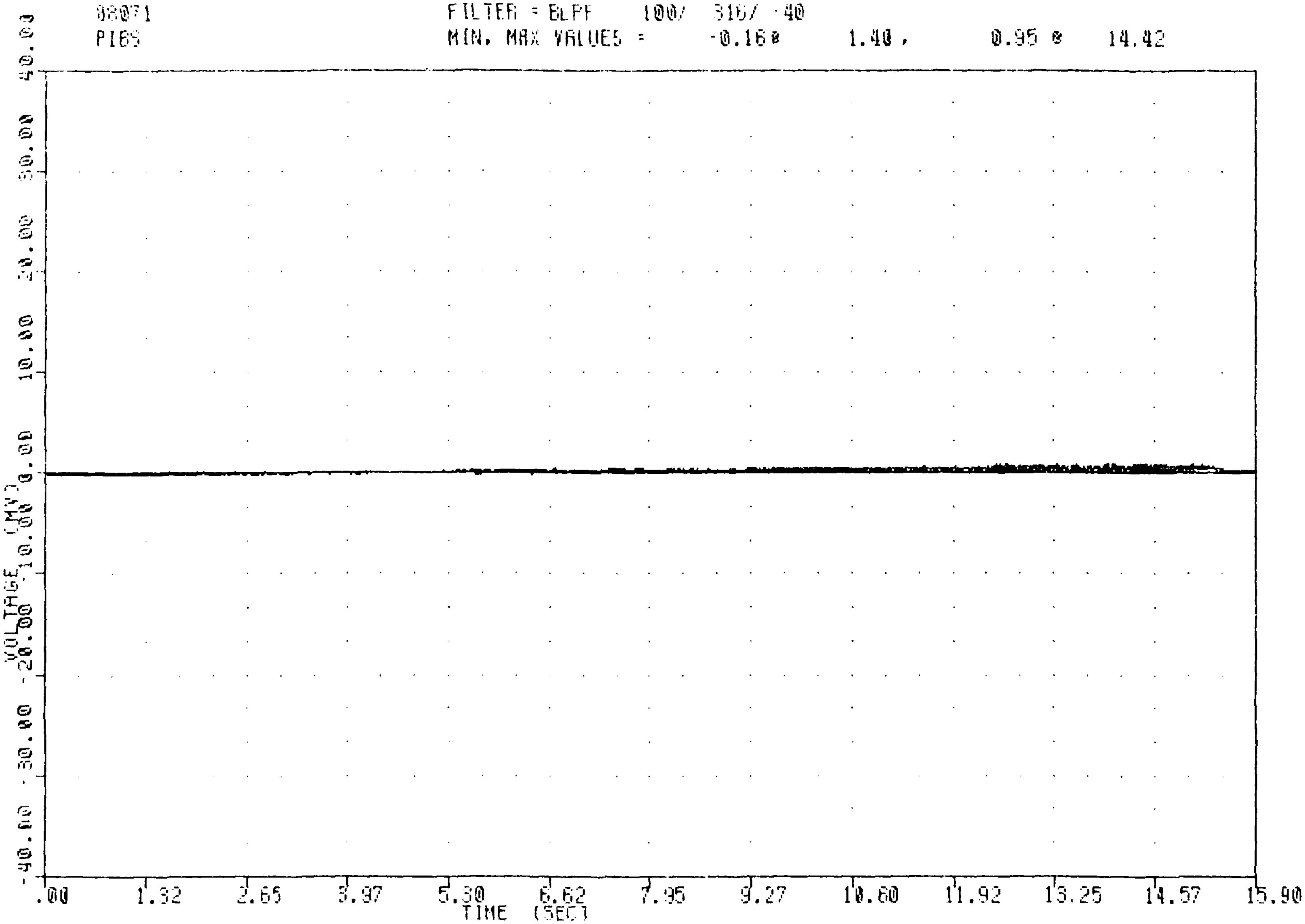
FAA . TE7703
VERTICAL PULL TESTS
33071
POBS

FILTER = ELPF 100/ 316/ -40
MIN. MAX VALUES = -6.50 @ 15.06 , -0.26 @ 15.90



LOAD APPLIED AT STARBOARD INBOARD SEAT TRACK
PORT OUTBOARD BEAM STRAIN

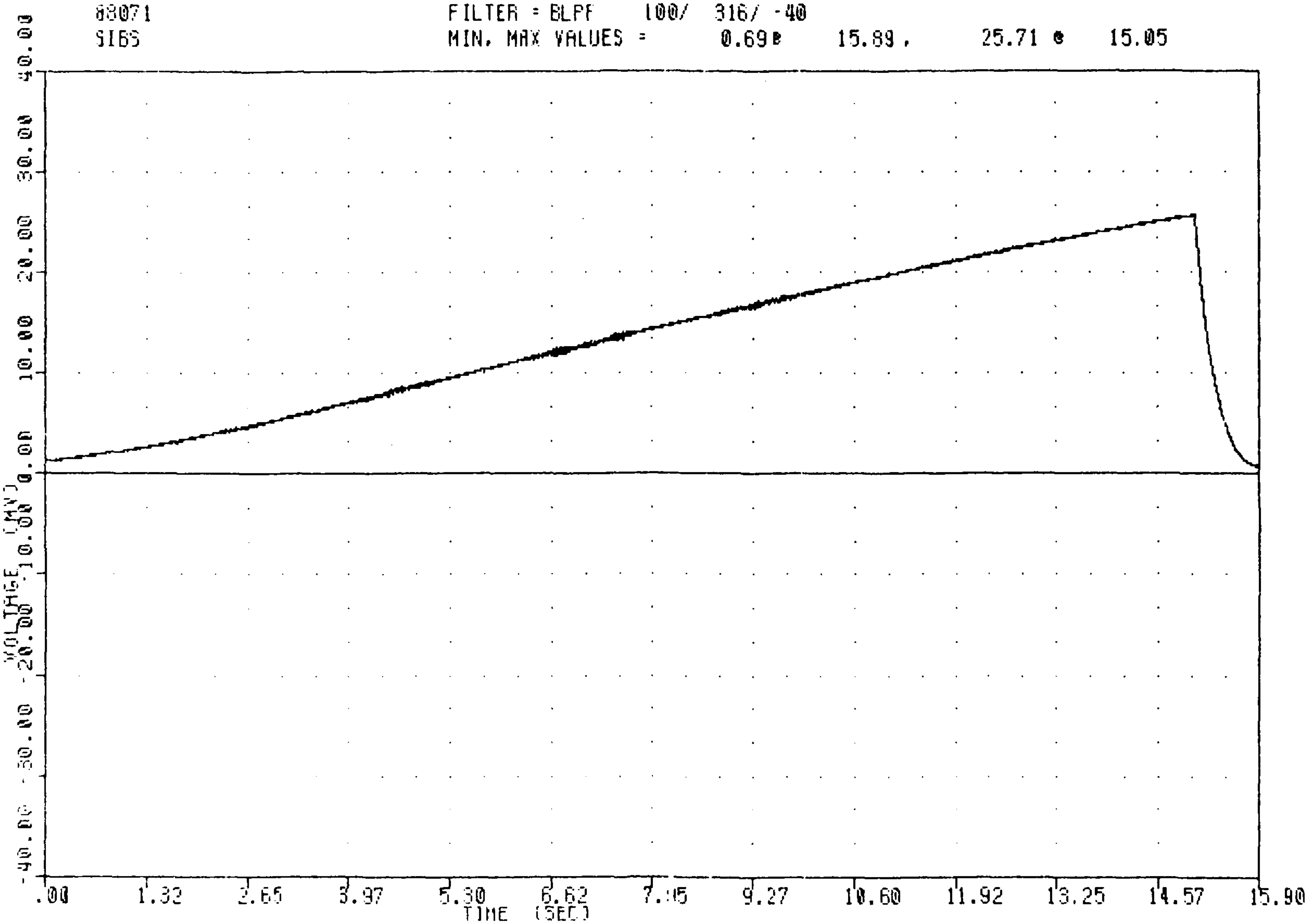
FAA , TEST08
VERTICAL PULL TESTS
88071 FILTER = BLPF 100/ 316/ 40
PI65 MIN, MAX VALUES = -0.16 @ 1.40 , 0.95 @ 14.42



LOAD APPLIED AT STARBOARD INBOARD SEAT TRACK
PORT INBOARD BEAM STRAIN

FAA , TEST03
VERTICAL PULL TESTS
88071
SIBS

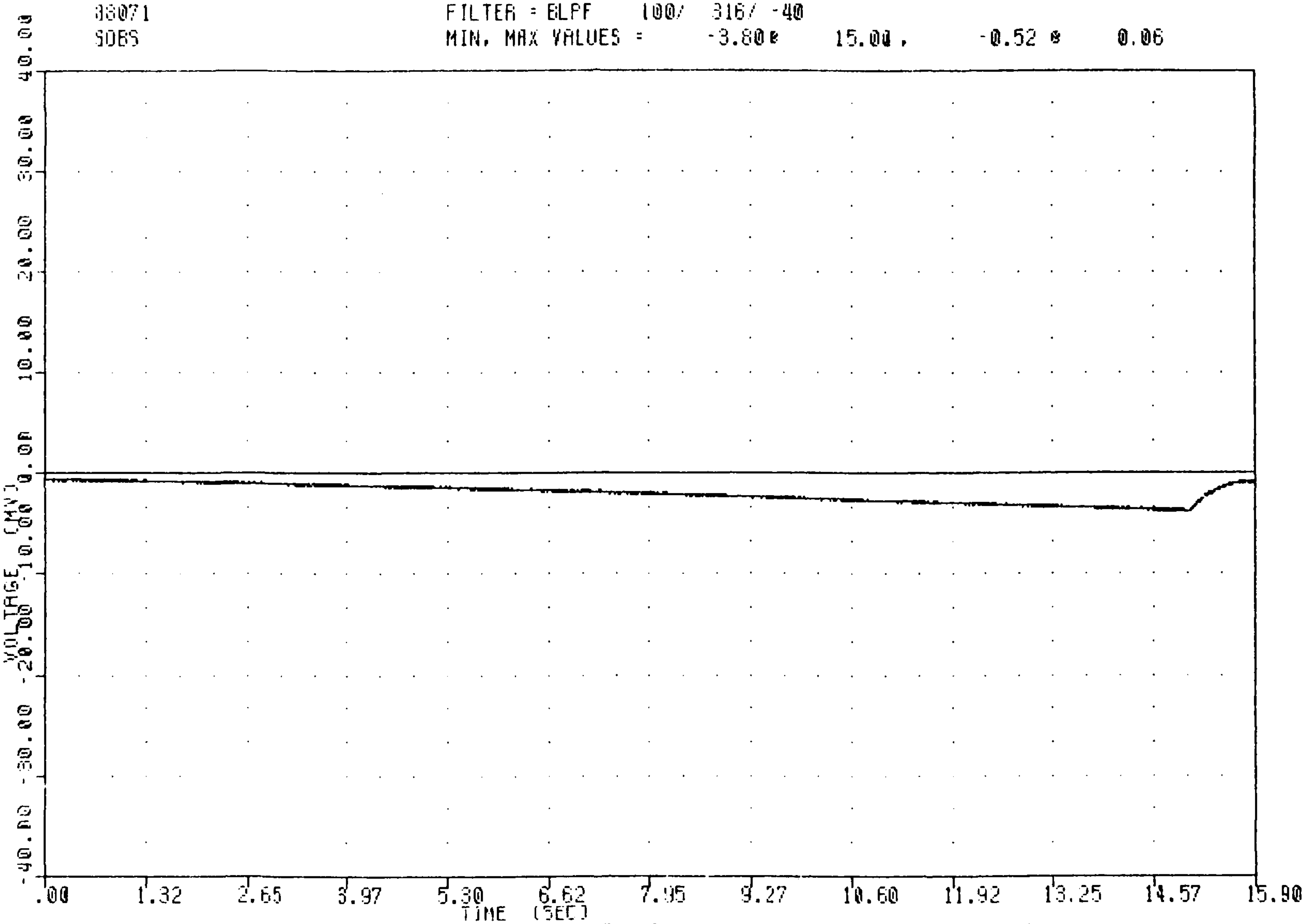
FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = 0.69 @ 15.89 , 25.71 @ 15.05



LOAD APPLIED AT STARBOARD INBOARD SEAT TRACK
STARBOARD INBOARD BEAM STRAIN

FAA , TEST03
VERTICAL PULL TESTS
38071
SDBS

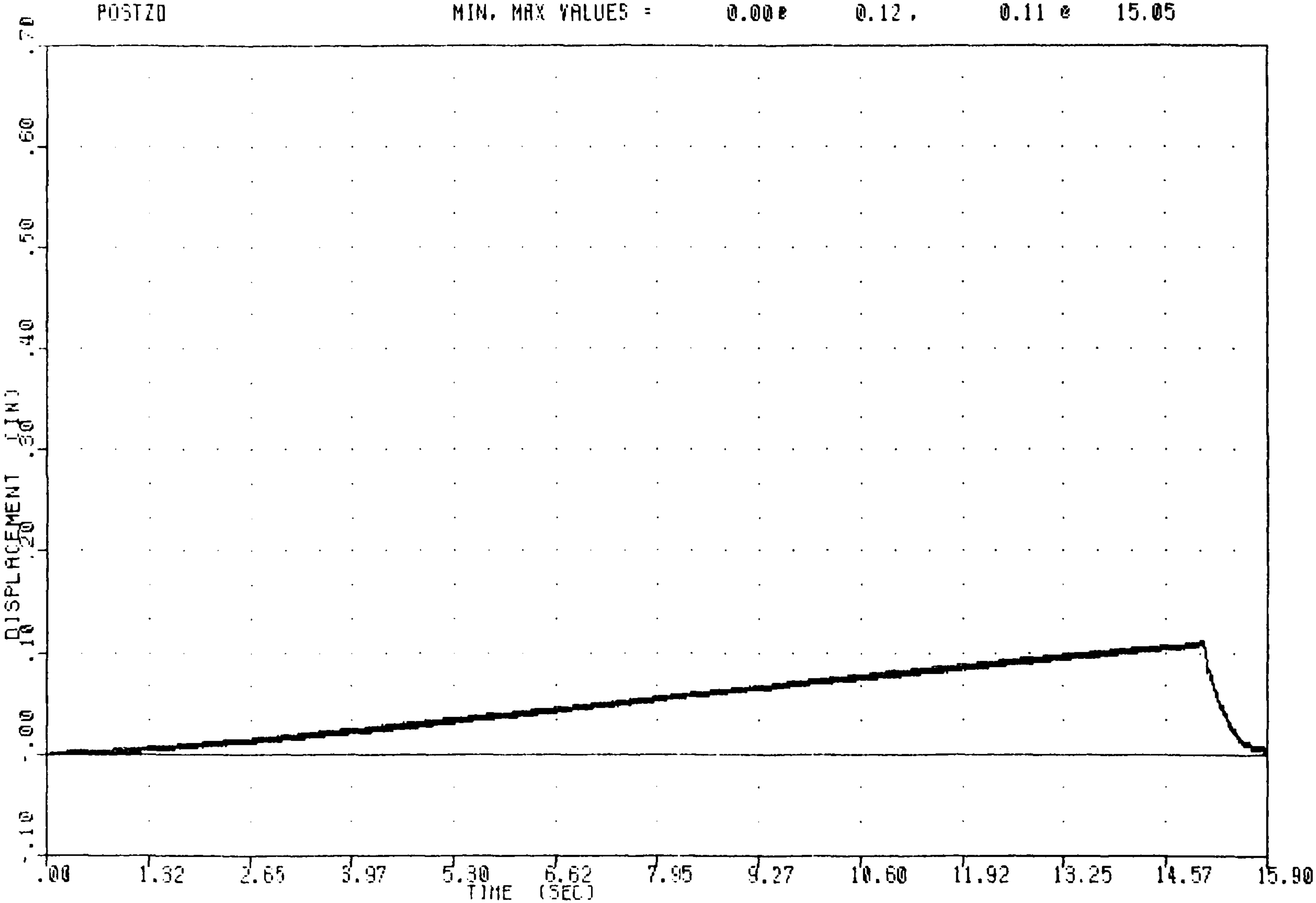
FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -3.80 15.00 -0.52 0.06



LOAD APPLIED AT STARBOARD INBOARD SEAT TRACK
STARBOARD OUTBOARD BEAM STRAIN

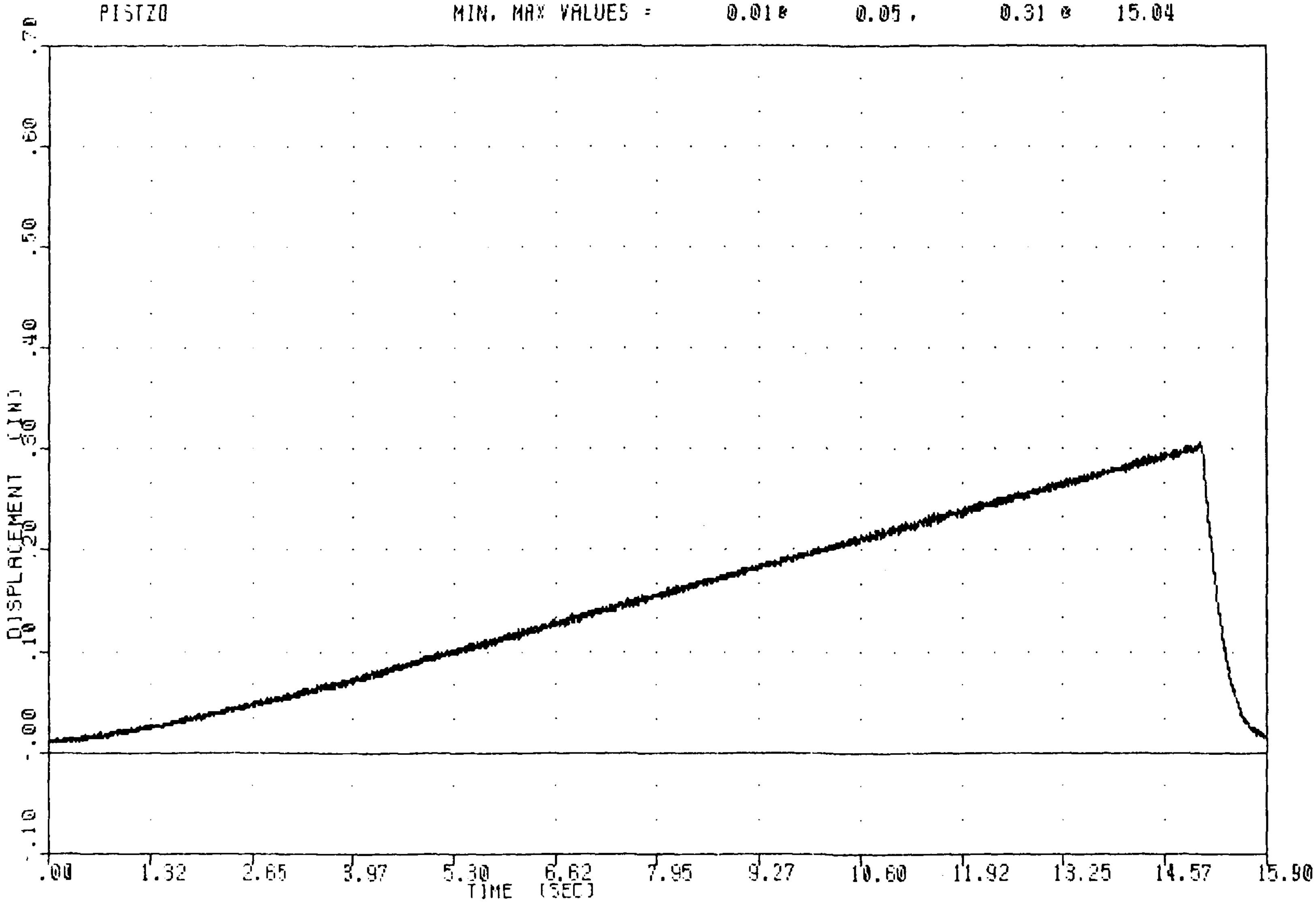
FAA , TEST03
VERTICAL PULL TESTS
88071
POSTZD

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = 0.00 @ 0.12 , 0.11 @ 15.05



LOAD APPLIED AT STARBOARD INBOARD SEAT TRACK
PORT OUTBOARD SEAT TRACK DEFLECTION

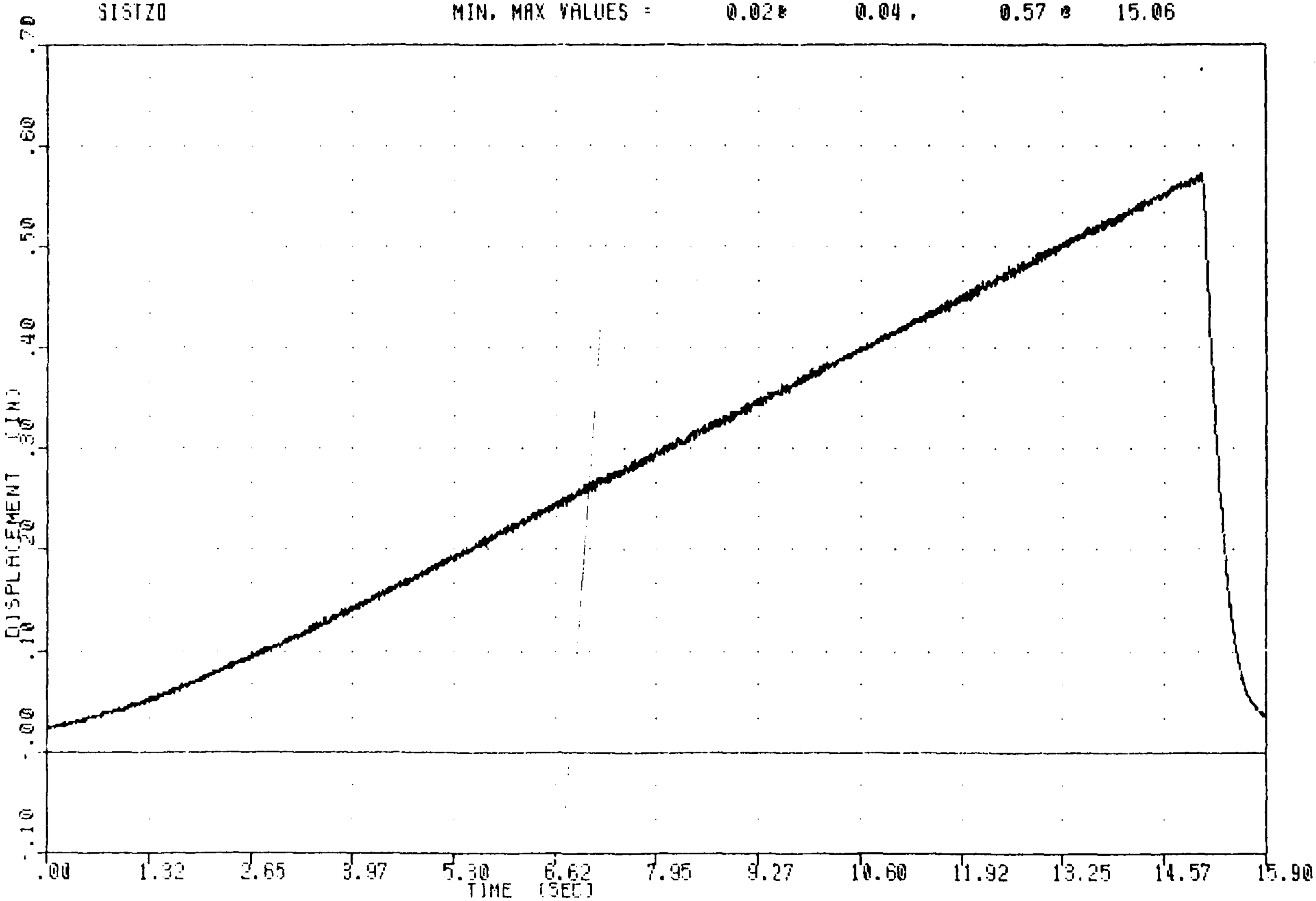
FAA , TEST03
VERTICAL PULL TESTS
88071 FILTER = BLPF 100/ 316/ -40
PISTZO MIN, MAX VALUES = 0.01 @ 0.05 , 0.31 @ 15.04



LOAD APPLIED AT STARBOARD INBOARD SEAT TRACK
PORT INBOARD SEAT TRACK DEFLECTION

FAA , TEST03
VERTICAL PULL TESTS
J8071
SISTZD

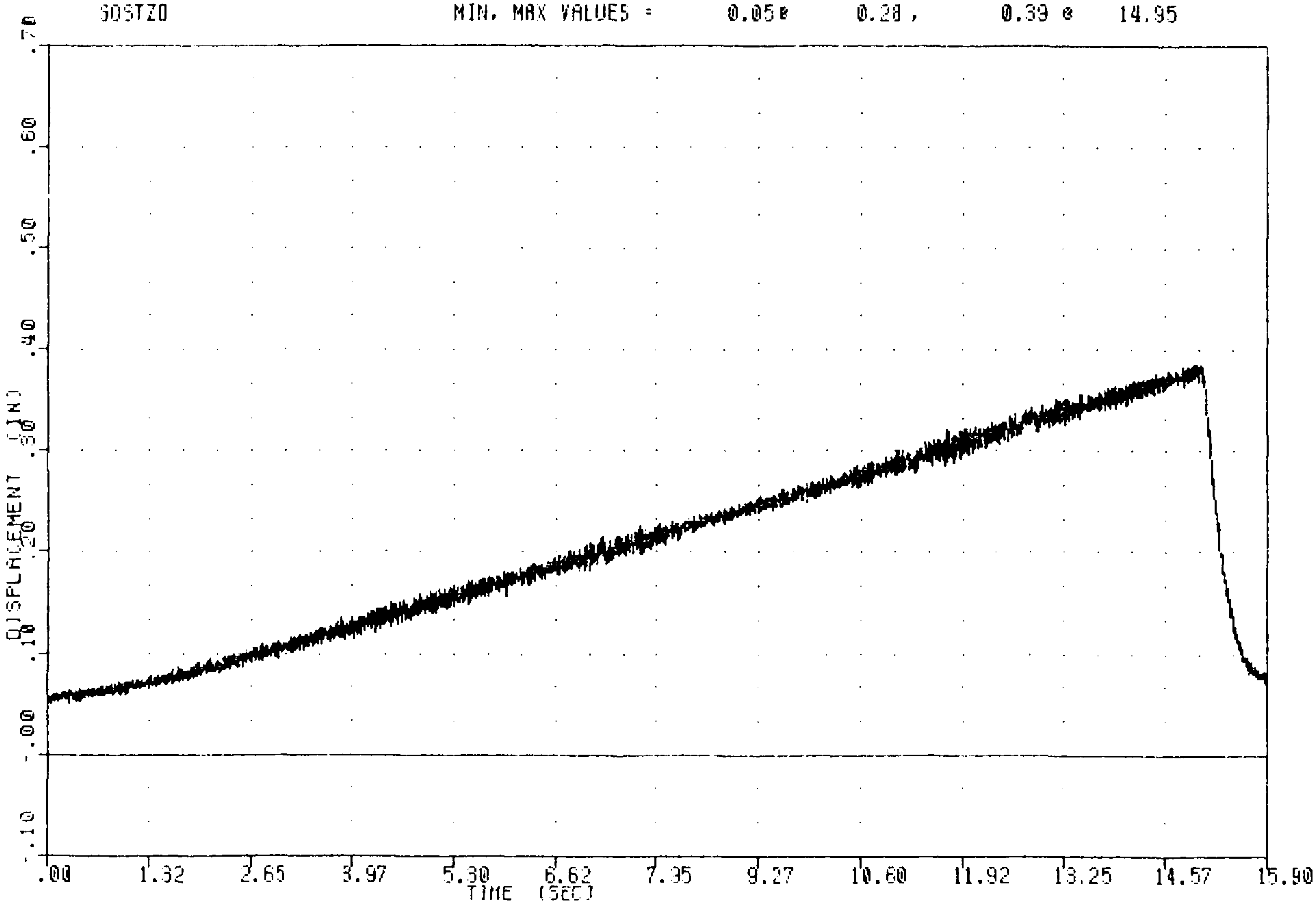
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = 0.02 @ 0.04 , 0.57 @ 15.06



LOAD APPLIED AT STARBOARD INBOARD SEAT TRACK
STARBOARD INBOARD SEAT TRACK DEFLECTION

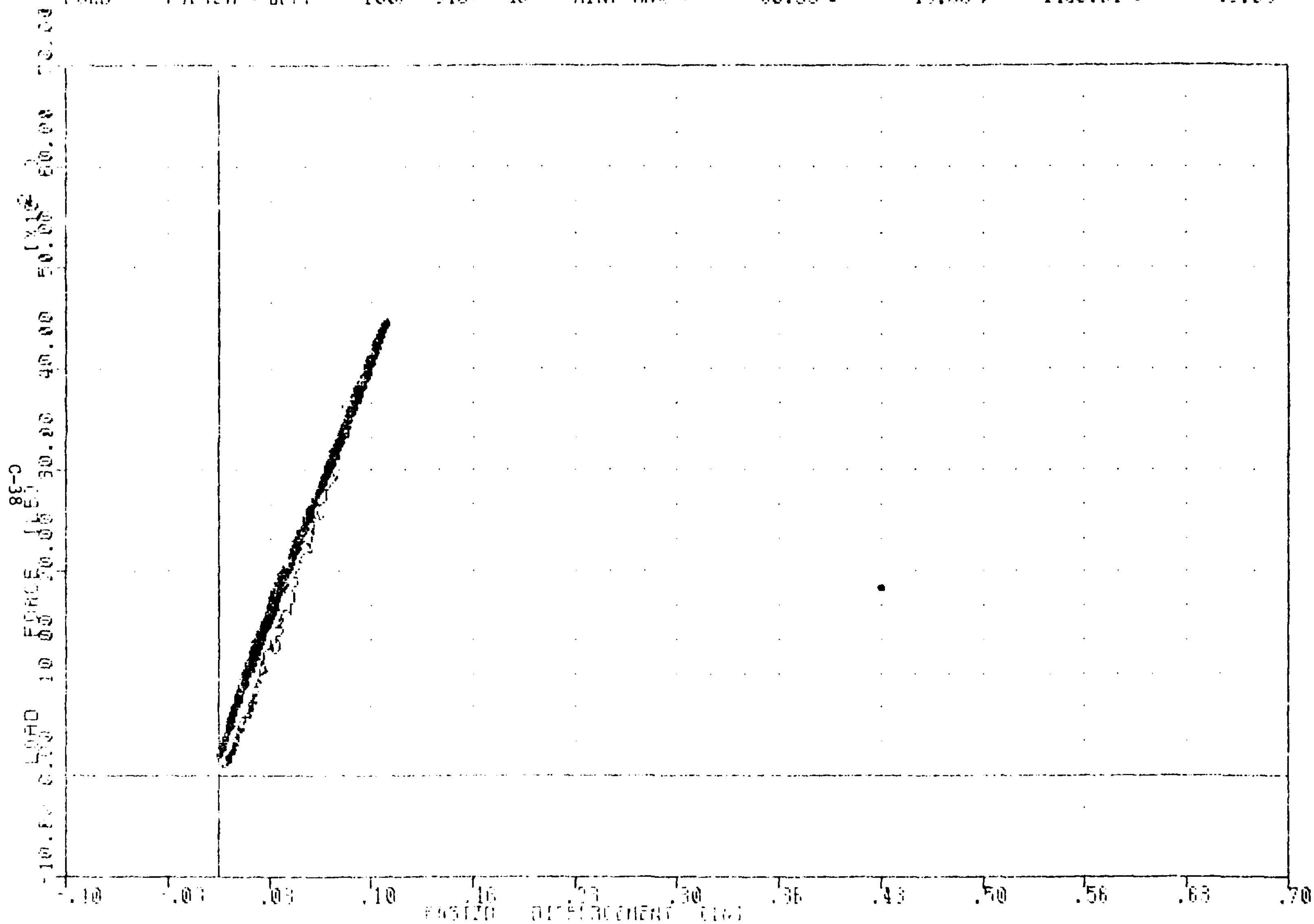
FAA , TEST03
VERTICAL PULL TESTS
88071
S0STZD

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = 0.05 @ 0.28 , 0.39 @ 14.95

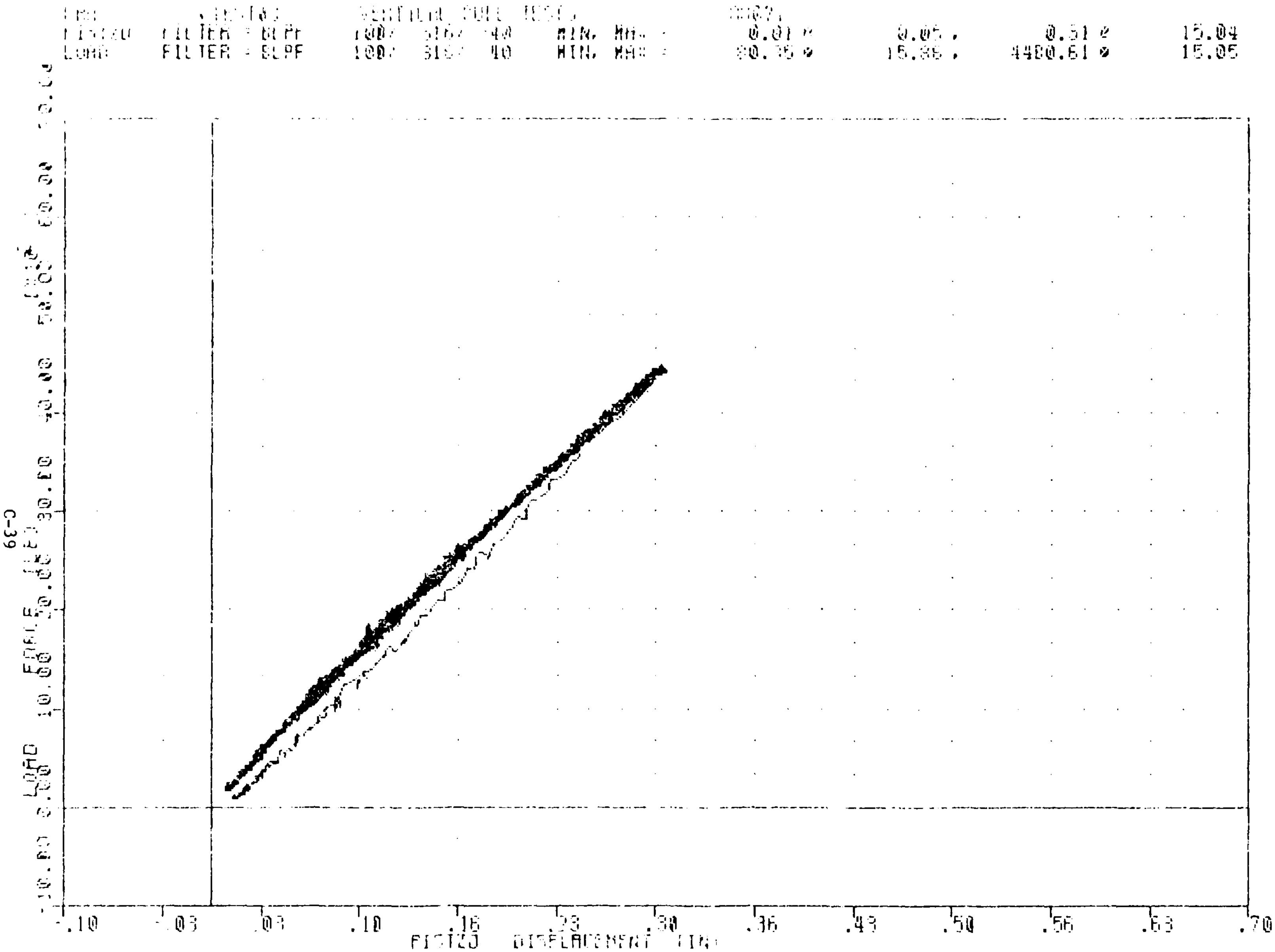


LOAD APPLIED AT STARBOARD INBOARD SEAT TRACK
STARBOARD OUTBOARD SEAT TRACK DEFLECTION

JOB JESTWS VERTICAL PULL TEST 88071
POSTZD FILTER = BLFF 100/ 316/ 40 MIN. MAX = 0.00 , 0.12 , 0.11 , 15.05
LOAD FILTER = BLFF 100/ 316/ 40 MIN. MAX = 80.35 , 15.86 , 480.61 , 15.05

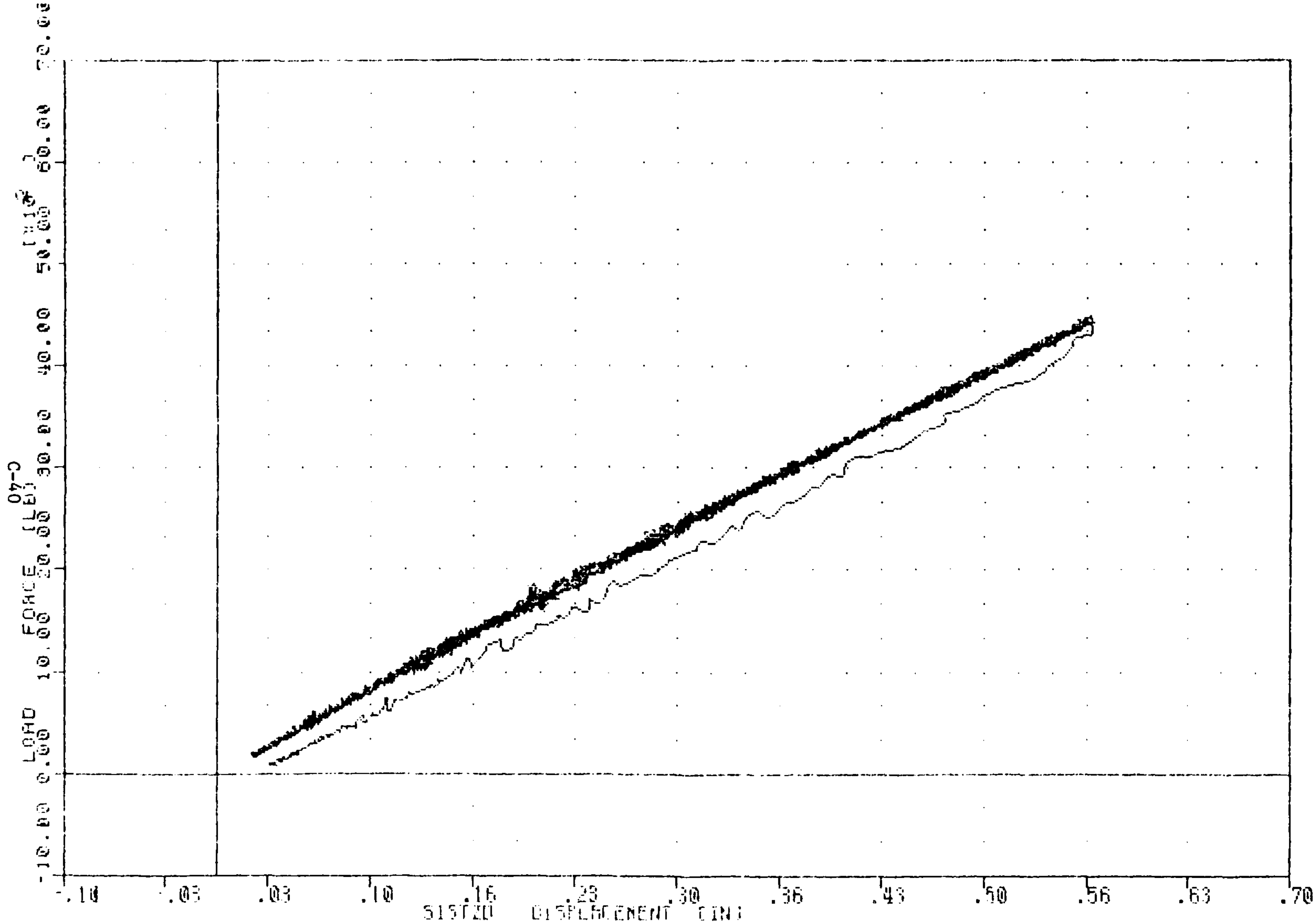


LOAD APPLIED AT OUTBOARD INBOARD SEAT TRACK
LOAD APPLIED TO SEAT TABLE VS LEFT OUTBOARD SEAT TRACK DEFLECTION



LOAD APPLIED AT STARBOARD INBOARD SEAT TRACK
LOAD APPLIED TO SEAT TRACK VS PORT INBOARD SEAT TRACK DEFLECTION

TAB	. . .T03	VERTICAL PULL TESTS		88071			
515I7D	FILTER : BLPF	100/ 316/ -40	MIN, MAX :	0.02 @	0.04 ,	0.57 @	15.06
LOAD	FILTER : BLPF	100/ 316/ -40	MIN, MAX :	80.35 @	15.86 ,	4430.61 @	15.05

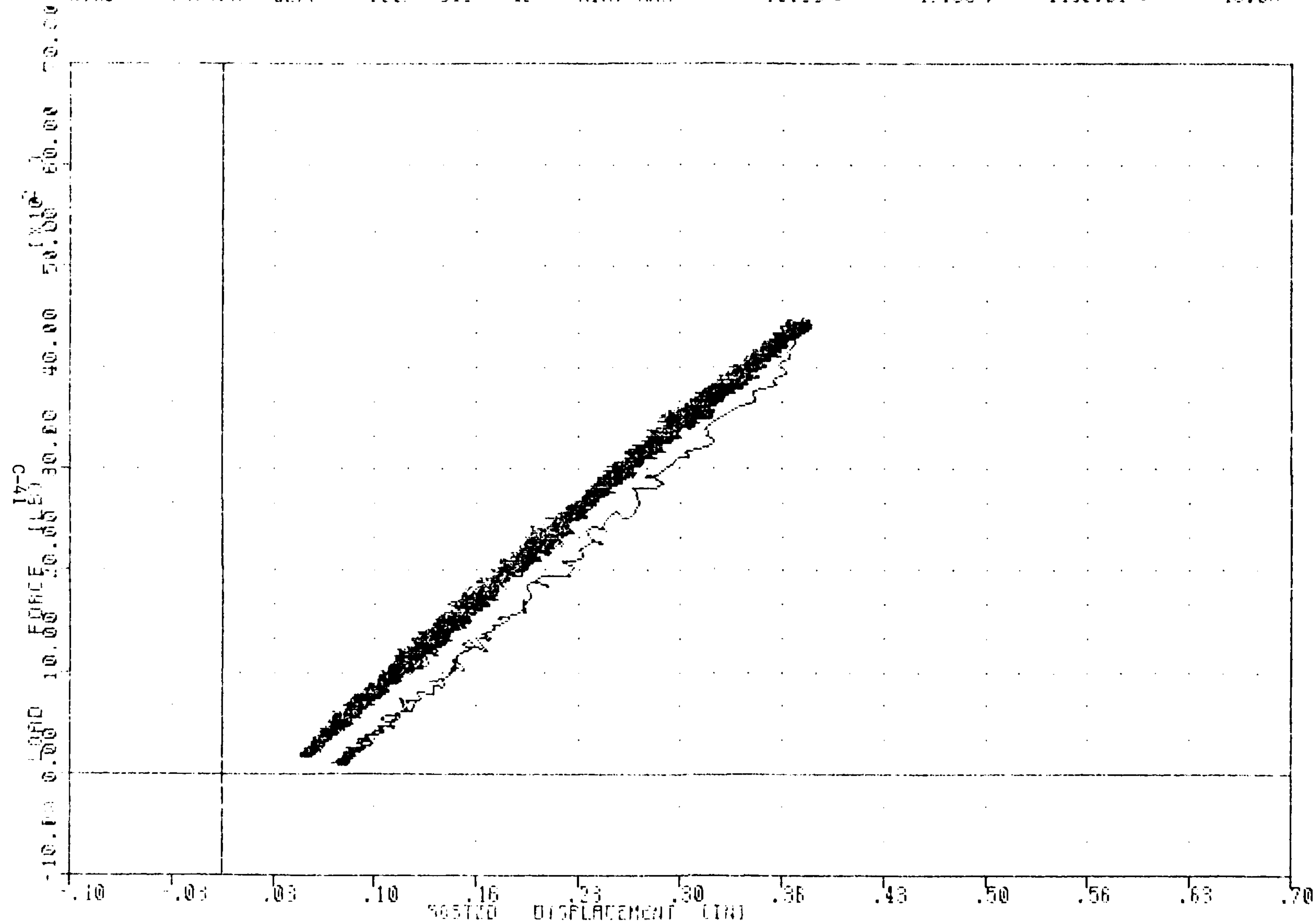


LOAD APPLIED AT STARBOARD INBOARD SEAT TRACK

LOAD APPLIED TO SEAT TRACK VS STARBOARD INBOARD SEAT TRACK DEFLECTION

VERTICAL PULL TESTS C8071

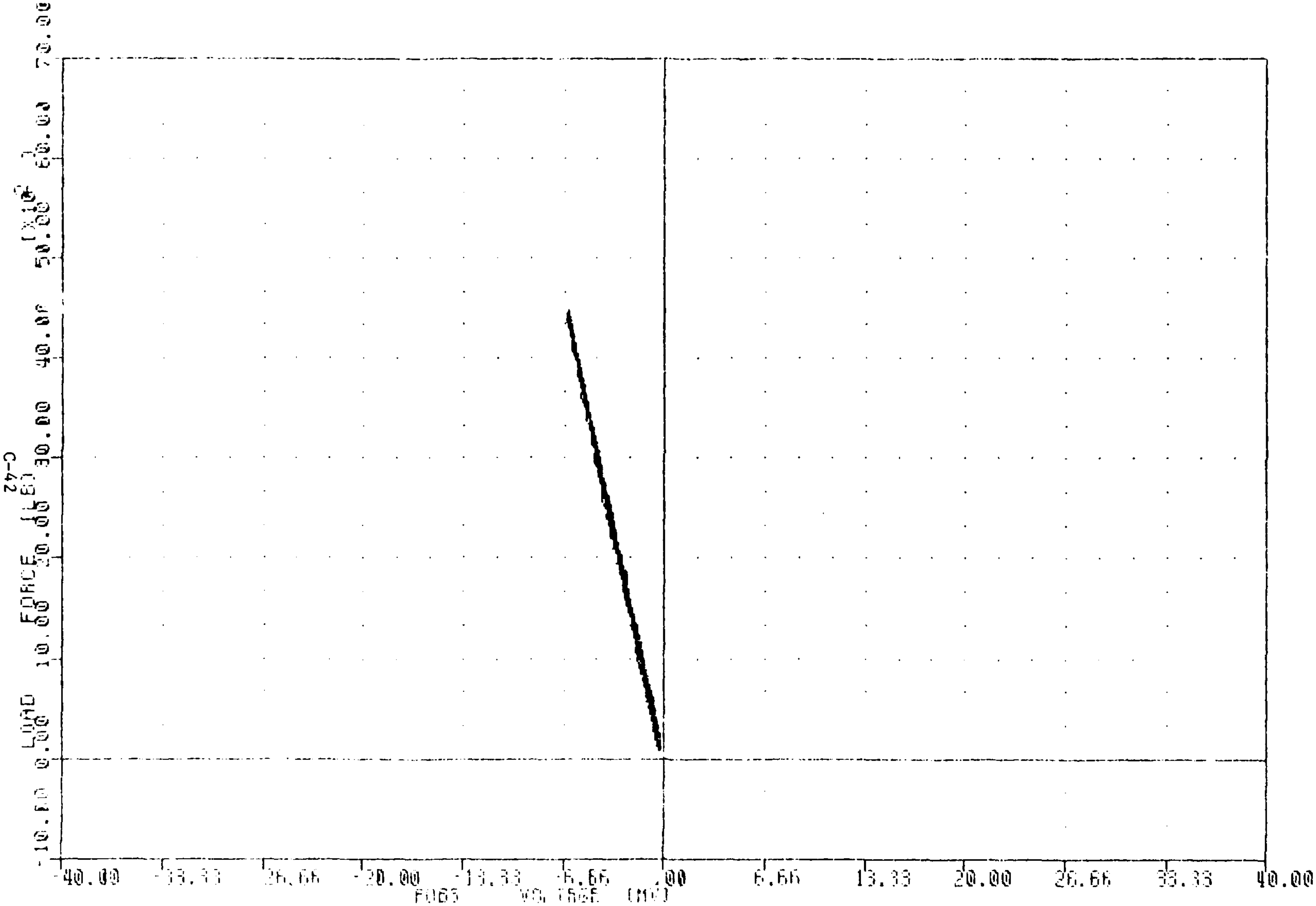
505T20	FILTER = 8LPF	100/ 316/ -40	MIN, MAX =	0.05 @	0.28 ,	0.35 @	14.95
LOAD	FILTER = 8LPF	100/ 316/ -40	MIN, MAX =	30.35 @	15.86 ,	4490.81 @	15.05



LOAD APPLIED AT STARBOARD INBOARD SEAT TRACK

LOAD APPLIED TO SEAT TRACK VS STARBOARD OUTBOARD SEAT TRACK DEFLECTION

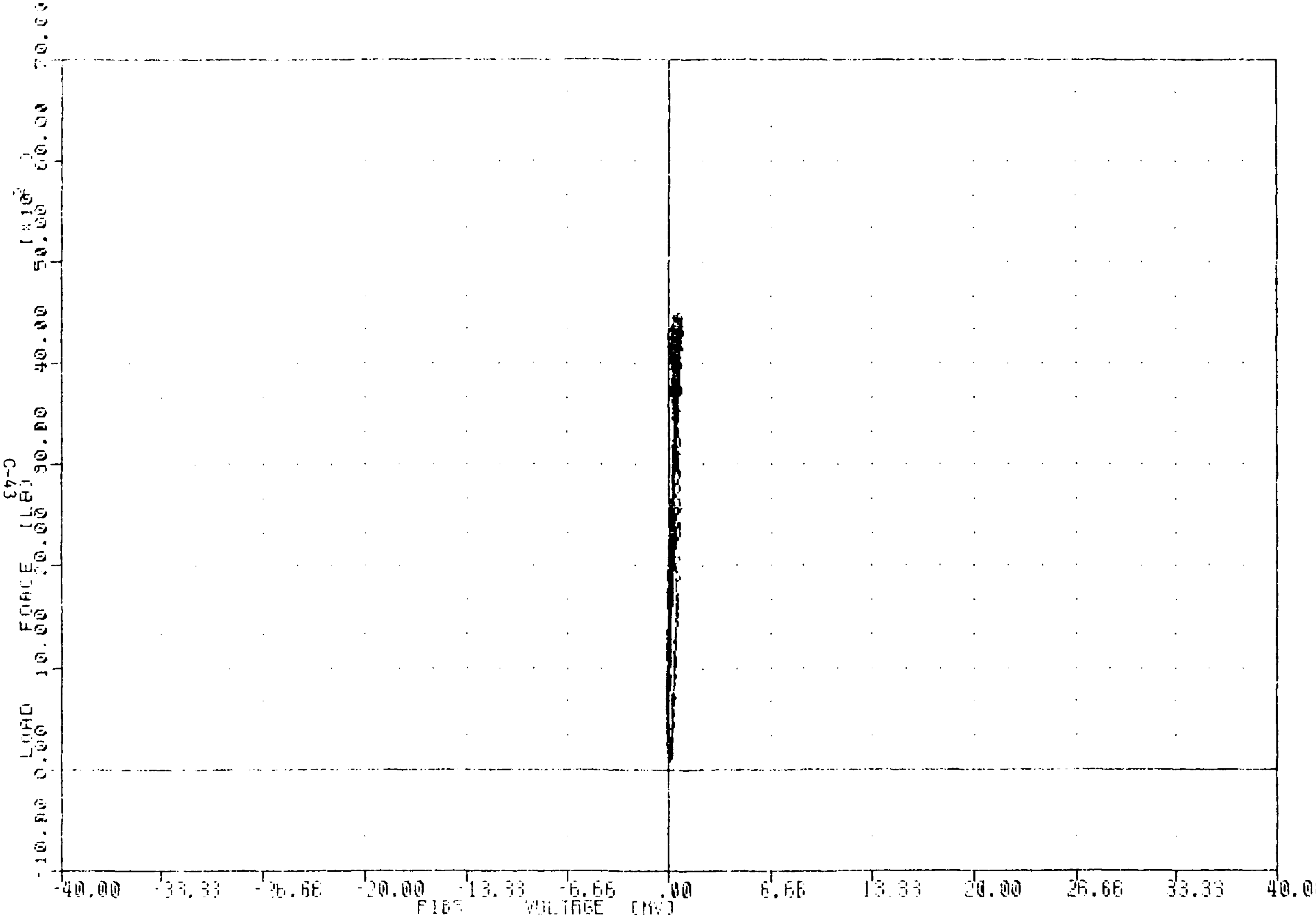
FAM TEST03 VERTICAL PULL TESTS 80021
FUGS FILTER = BLPF 100/ 316/ -40 MIN, MAX = -6.50 @ 15.06 , -0.26 @ 15.90
LOAD FILTER = BLPF 100/ 316/ -40 MIN, MAX = 80.35 @ 15.86 , 4980.61 @ 15.05



LOAD APPLIED AT STARBOARD INBOARD SEAT TRACK

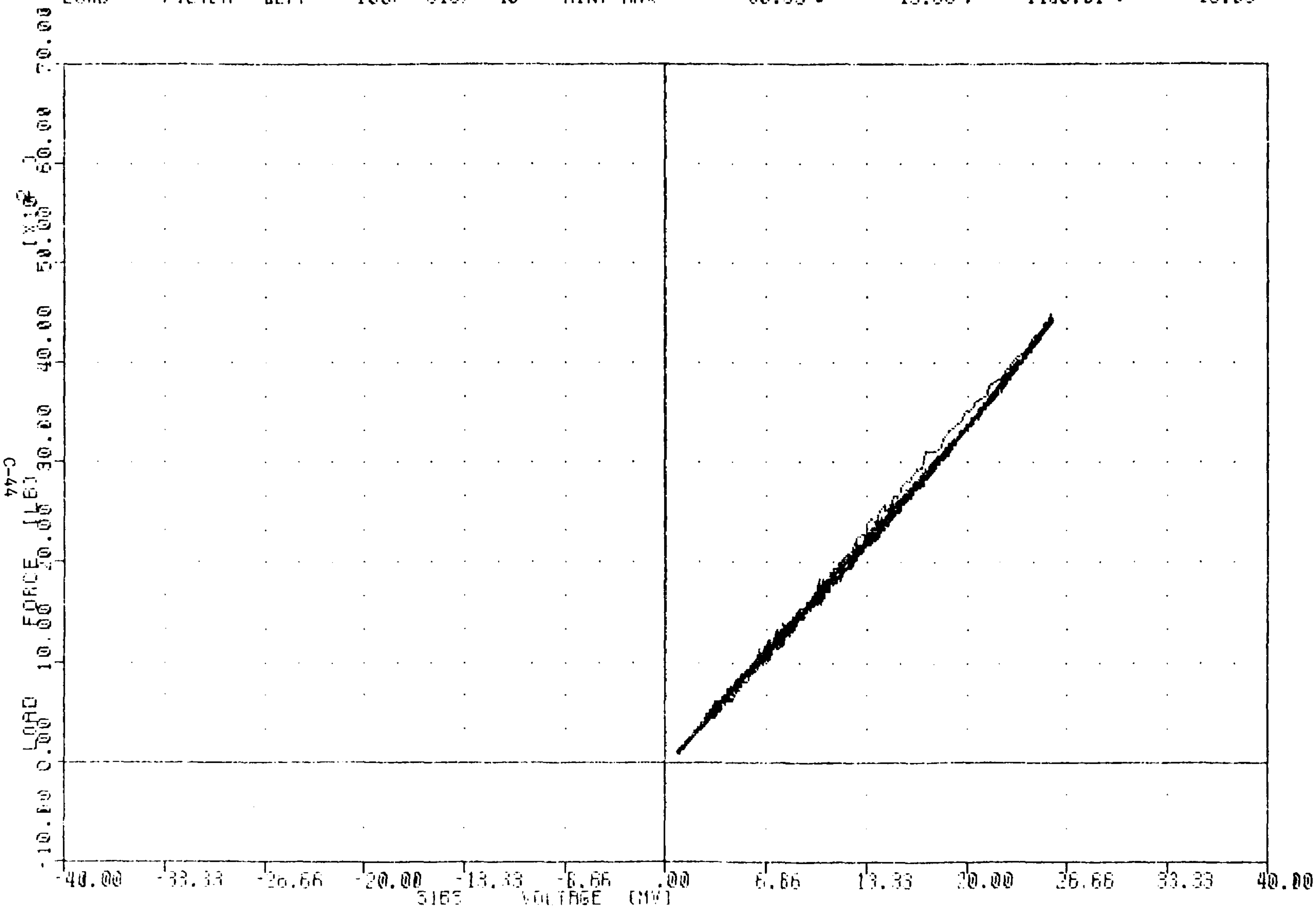
LOAD APPLIED TO SEAT TRACK VS PORT OUTBOARD BEAM STRAIN

F165 FILTER - BLFF 100/ 316/ -40 MIN, MAX : -0.16 @ 1.40 , 0.95 @ 14.42
LOAD FILTER - BLFF 100/ 316/ -40 MIN, MAX : 80.35 @ 15.96 , 4480.61 @ 15.05



LOAD APPLIED AT STARBOARD INBOARD SEAT TRACK
LOAD APPLIED TO SEAT TRACK V. AFT INBOARD SPAR STRAIN

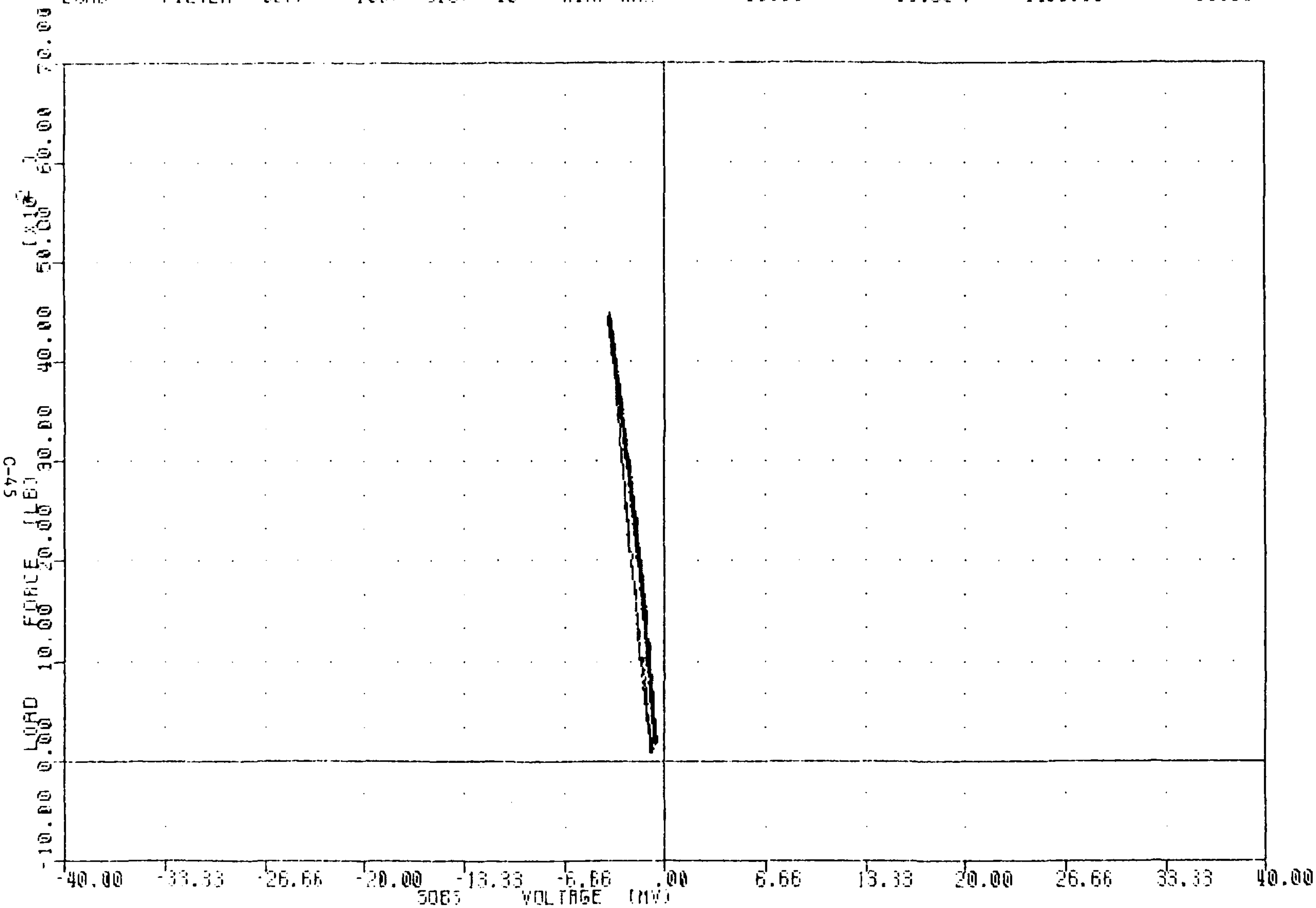
FAA .T*ST03 VERTICAL PULL TESTS 88071
SIBS FILTER = BLPF 100/ 316/ -40 MIN. MAX = 0.69 15.89 , 25.71 15.05
LOAD FILTER = BLPF 100/ 316/ -40 MIN. MAX = 80.35 15.86 , 4480.61 15.05



LOAD APPLIED AT STARBOARD INBOARD SEAT TRACK

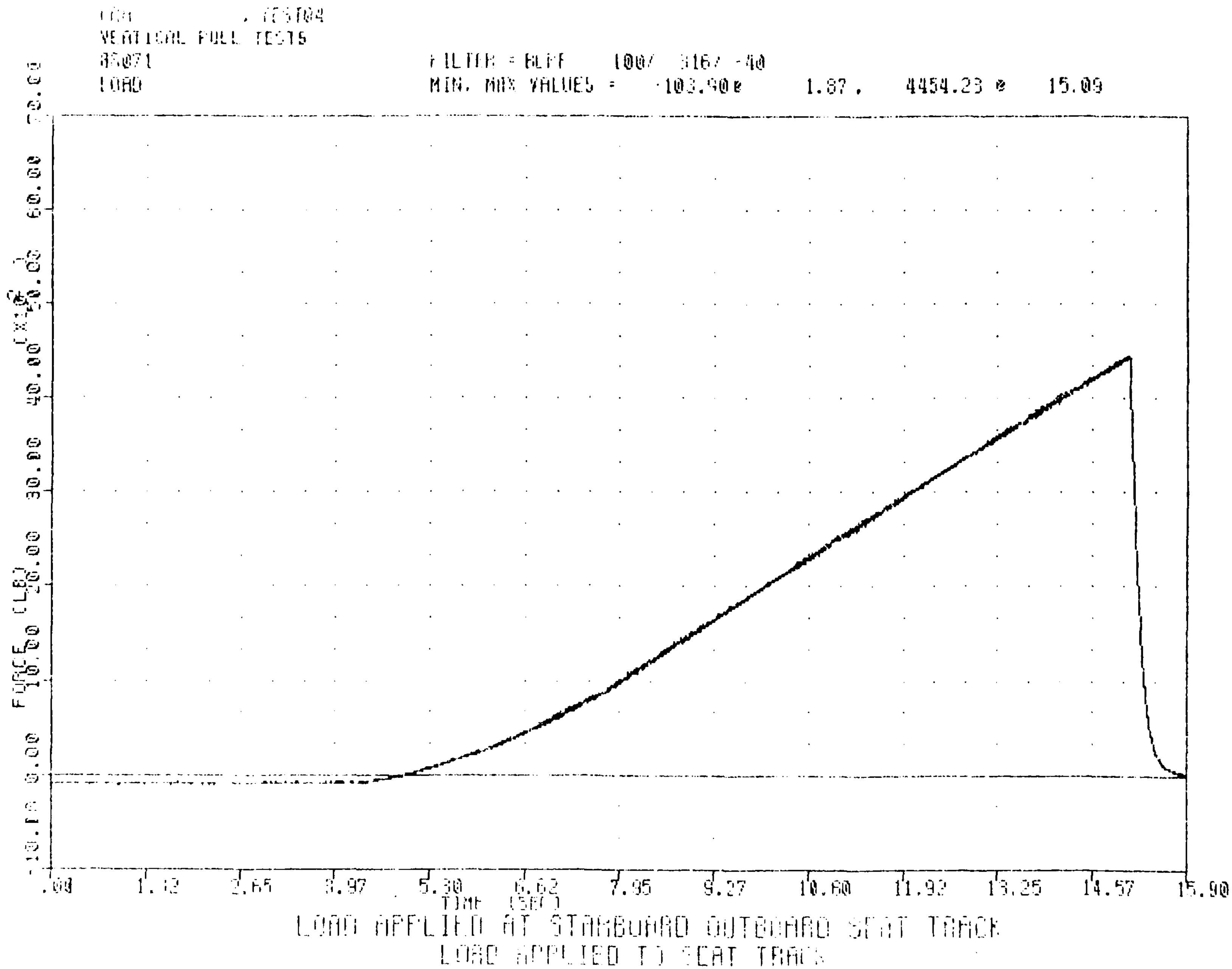
LOAD APPLIED TO TEST TRACK VS STARBOARD INBOARD BEAM STRAIN

FAA	.TEST03	VERTICAL PULL TESTS		88071				
5085	FILTER = BLPF	100/ 316/ -40	MIN, MAX =	-3.30 @	15.00 ,	-0.52 @	0.06
LOAD	FILTER = BLPF	100/ 316/ -40	MIN, MAX =	80.35 @	15.86 ,	4480.61 @	15.05



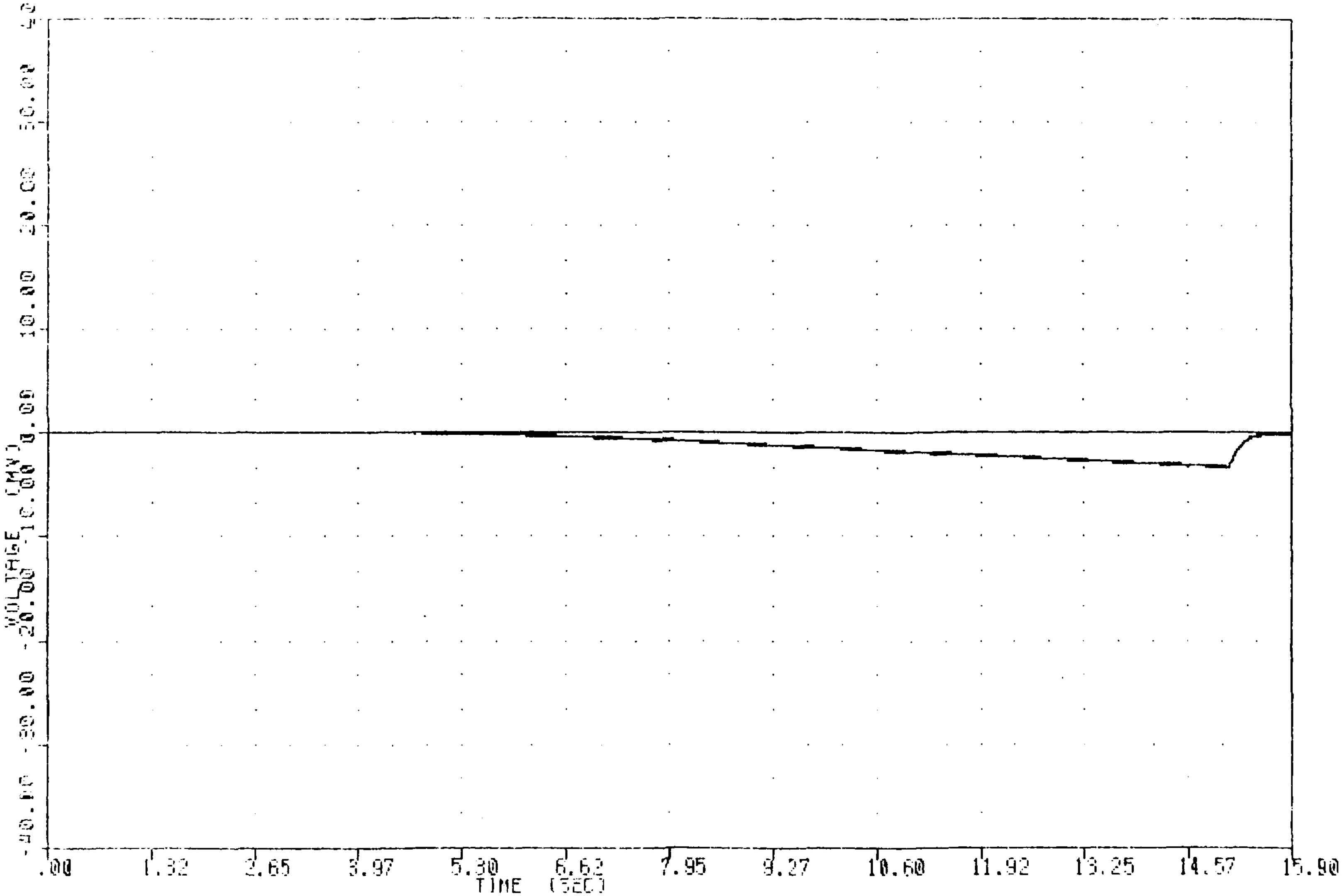
LOAD APPLIED AT STARBOARD INBOARD SEAT TRACK

LOAD APPLIED TO SEAT TRACK VS STARBOARD OUTBOARD BEAM STRAIN


VERTICAL PULL TESTS
85071
LOAD
FILTER = BUFF 100/ 3167-40
MIN, MAX VALUES = -103.90 @ 1.87 , 4454.23 @ 15.09
FORCE (LB) (X10)
-10.10
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
.00
1.32
2.65
3.97
5.30
6.62
7.95
9.27
10.60
11.92
13.25
14.57
15.90
TIME (SEC)
LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK
LOAD APPLIED TO SEAT TRACK

TEST00
VERTICAL PULL TESTS
J5071
P085

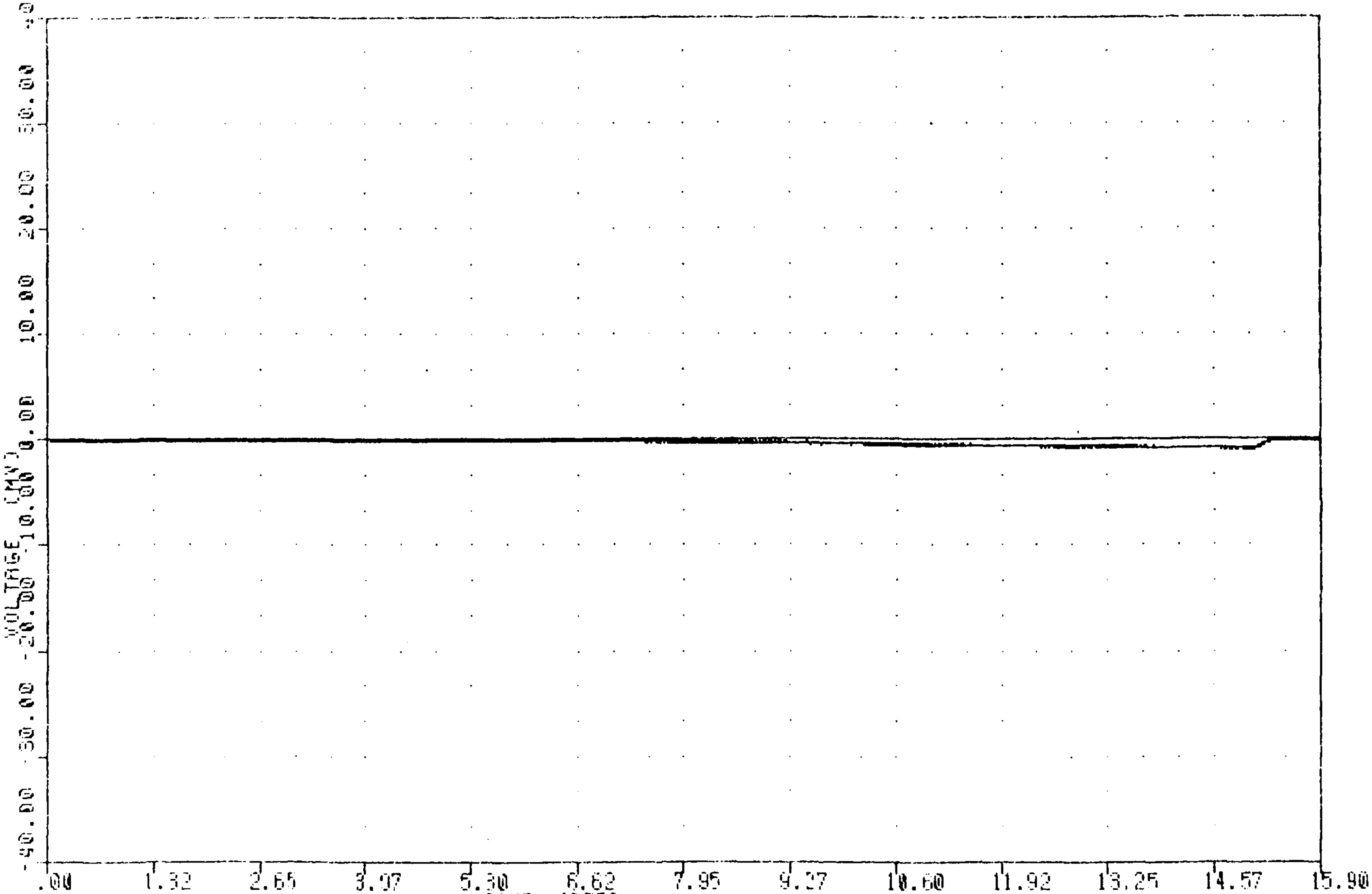
FILTER = ELPF 100/ 3167 40
MIN, MAX VALUES = 3.34 @ 15.10 , 0.06 @ 1.31



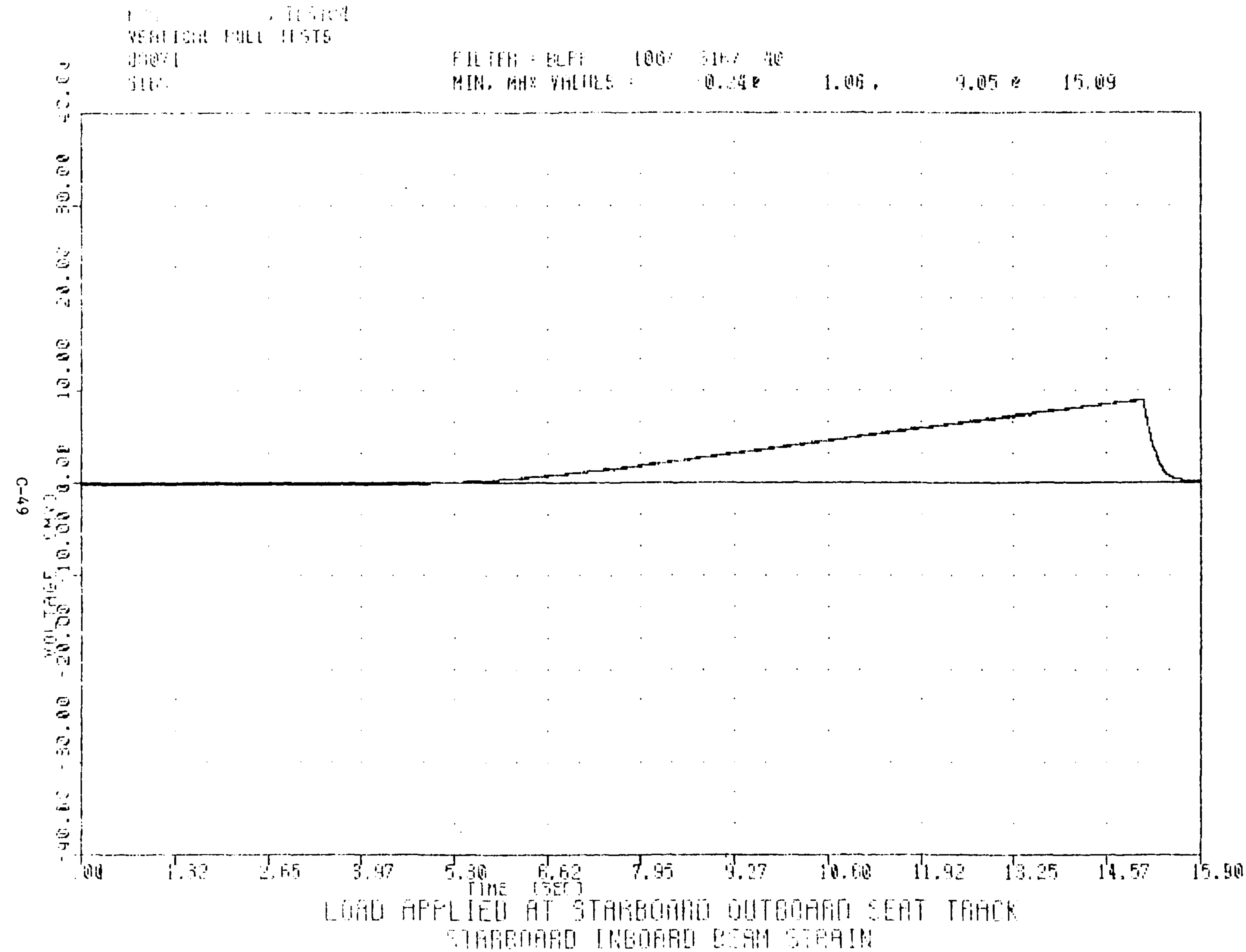
LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK
PORT OUTBOARD BEAM STRAIN

VERTICAL PULL TESTS
A8071
PIBS

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.94 @ 15.01, 0.00 @ 0.14



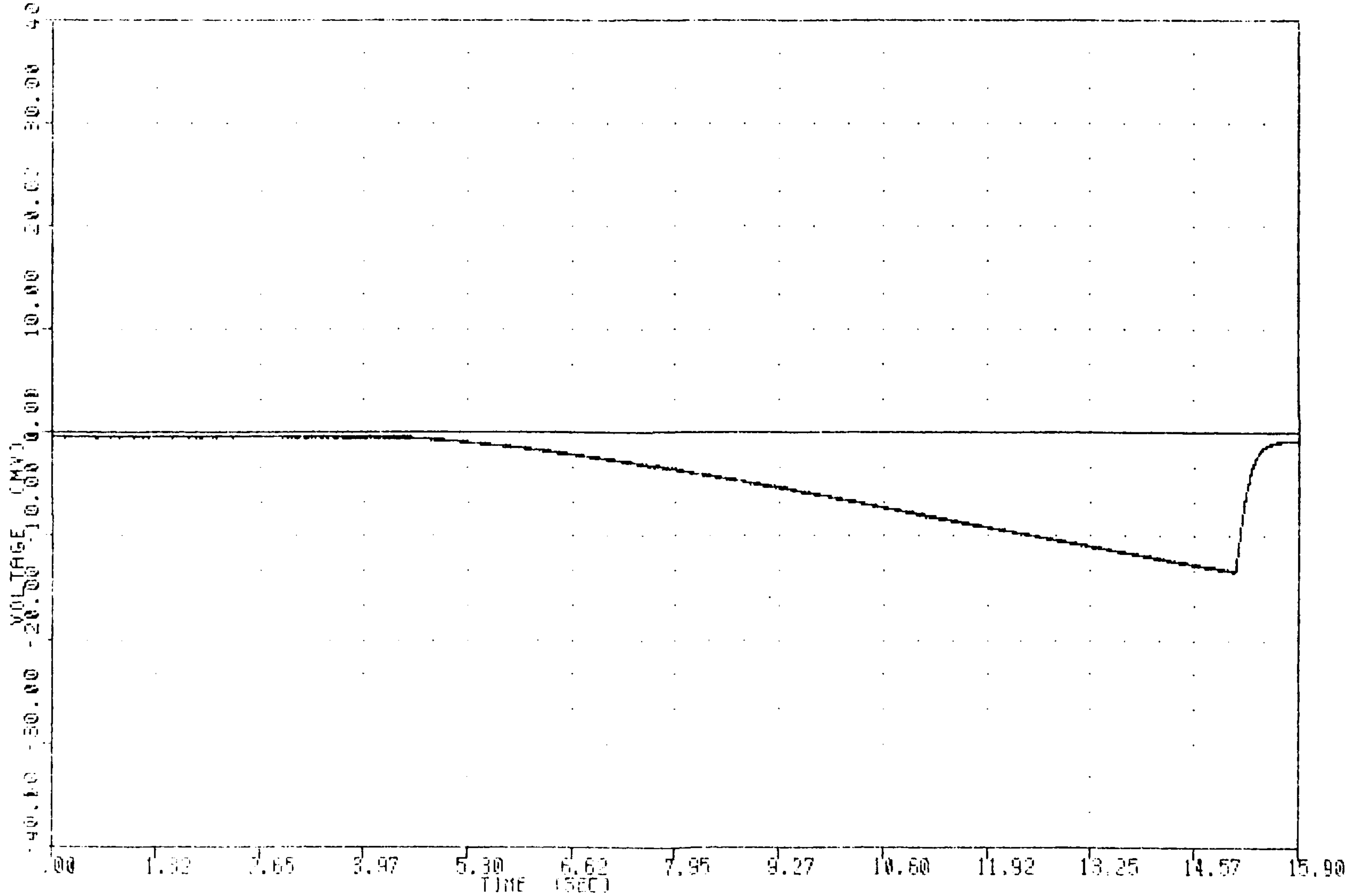
LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK
PORT INBOARD BEAM STRAIN



VERTICAL PULL TESTS
FILTER : BLPF 100/ SIK/ 40
MIN, MAX VALUES : -0.24 @ 1.06 , 9.05 @ 15.09
VOLTAGE (MV)
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
.00
1.32
2.65
3.97
5.30
6.62
7.95
9.27
10.60
11.92
13.25
14.57
15.90
TIME (SEC)
LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK
STARBOARD INBOARD BEAM STRAIN

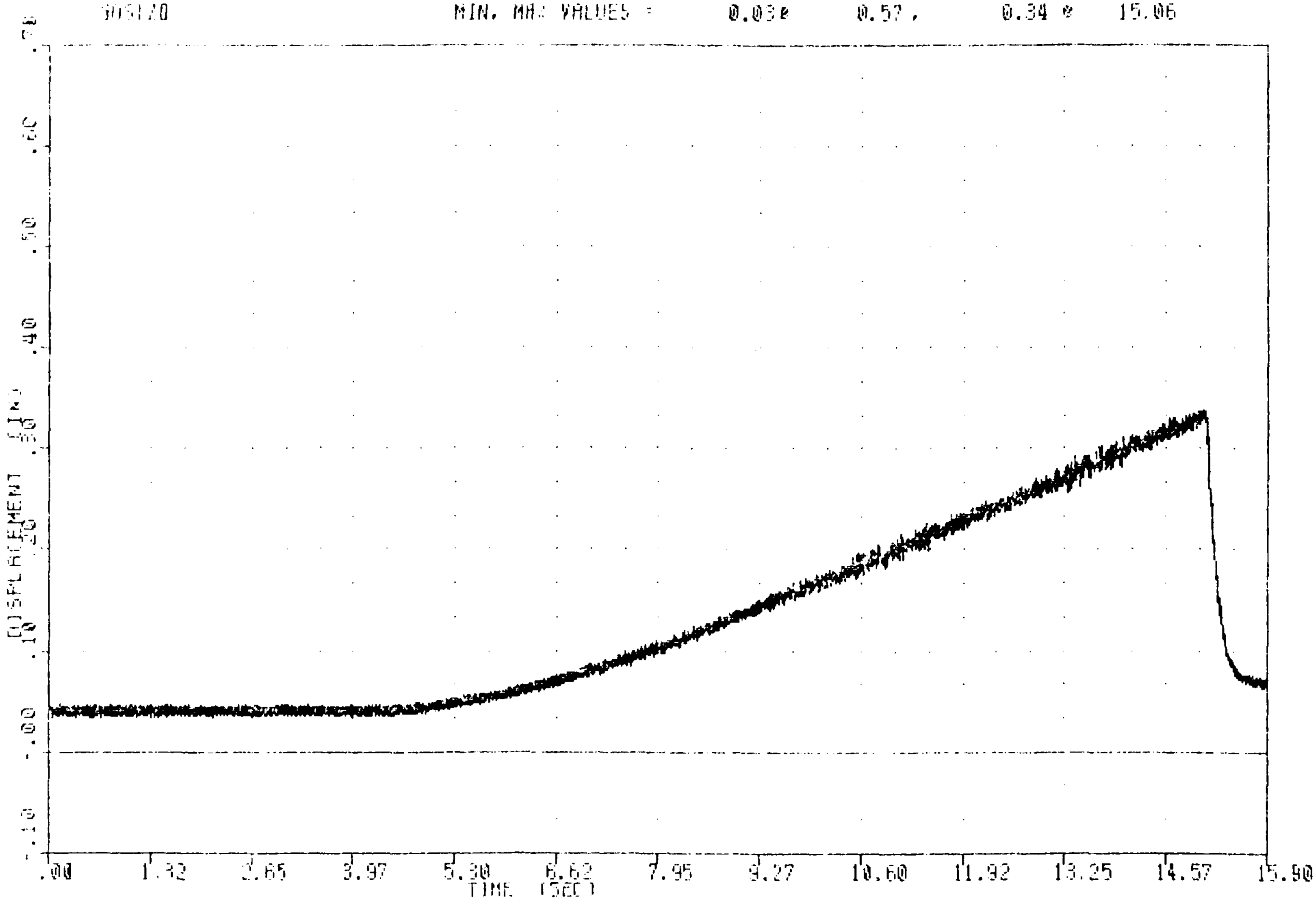
FMV . TESTSN
VERTICAL PULL TESTS
45071
3085

FILTER = BLPF 100/ 316/ 40
MIN, MAX VALUES = -13.48 @ 15.10 , -0.36 @ 0.96



LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK
STARBOARD OUTBOARD BEAM STRAIN

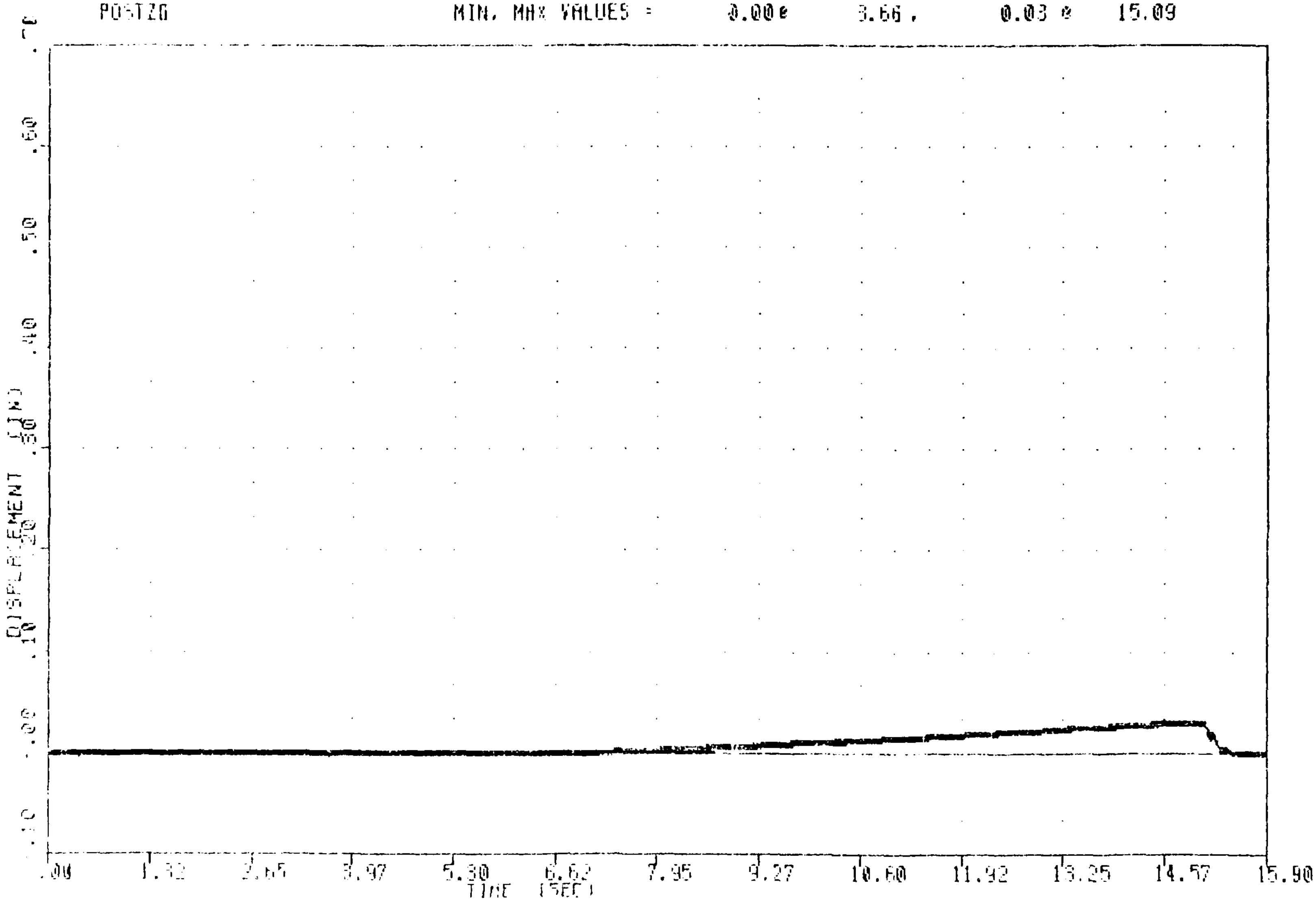
FAA . TESTS
VERTICAL PULL TESTS
J5021 FILTER : BLPF 100/ 316/ 40
905170 MIN, MAX VALUES = 0.03 @ 0.57 , 0.34 @ 15.06



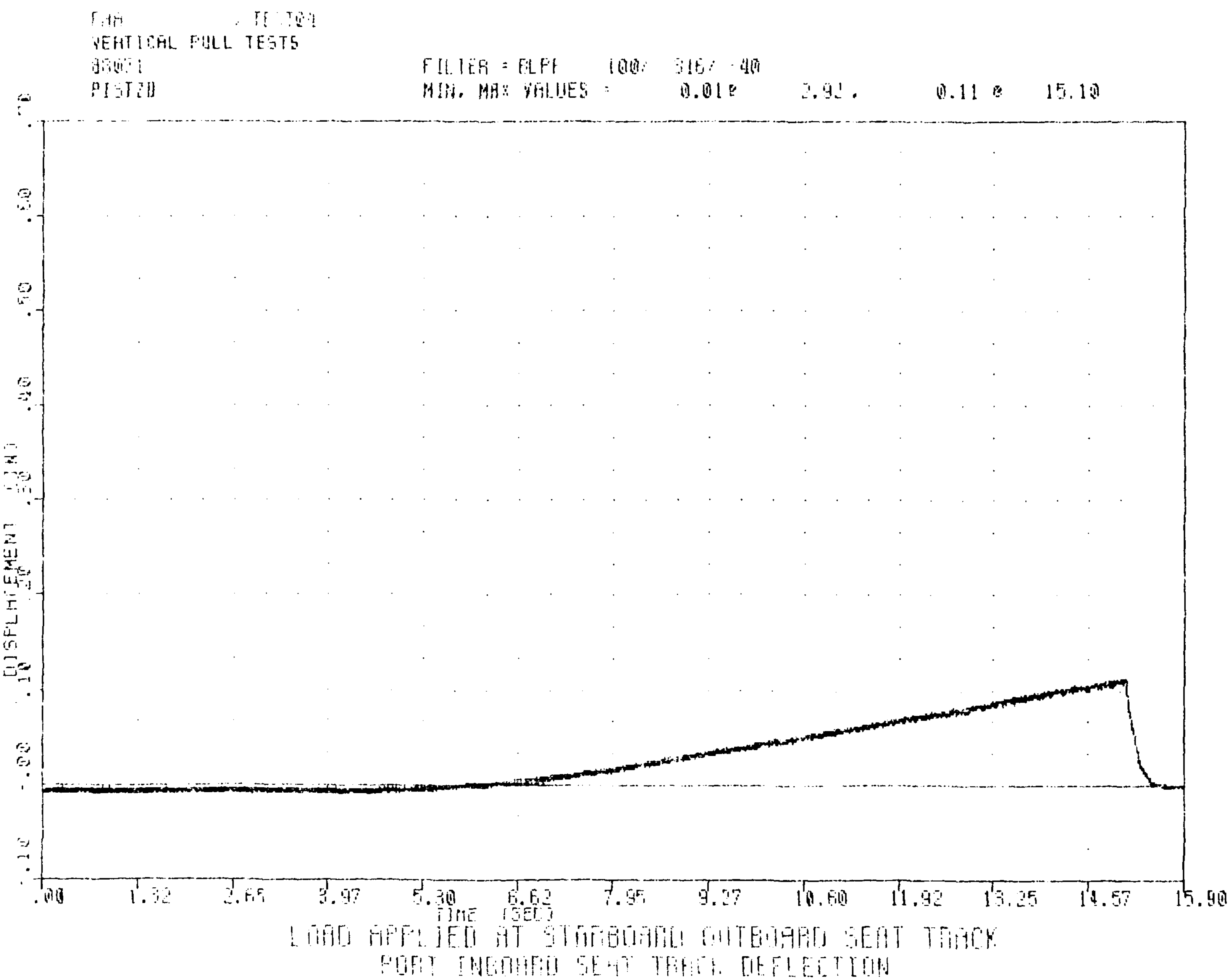
LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK
STARBOARD OUTBOARD SEAT TRACK DEFLECTION

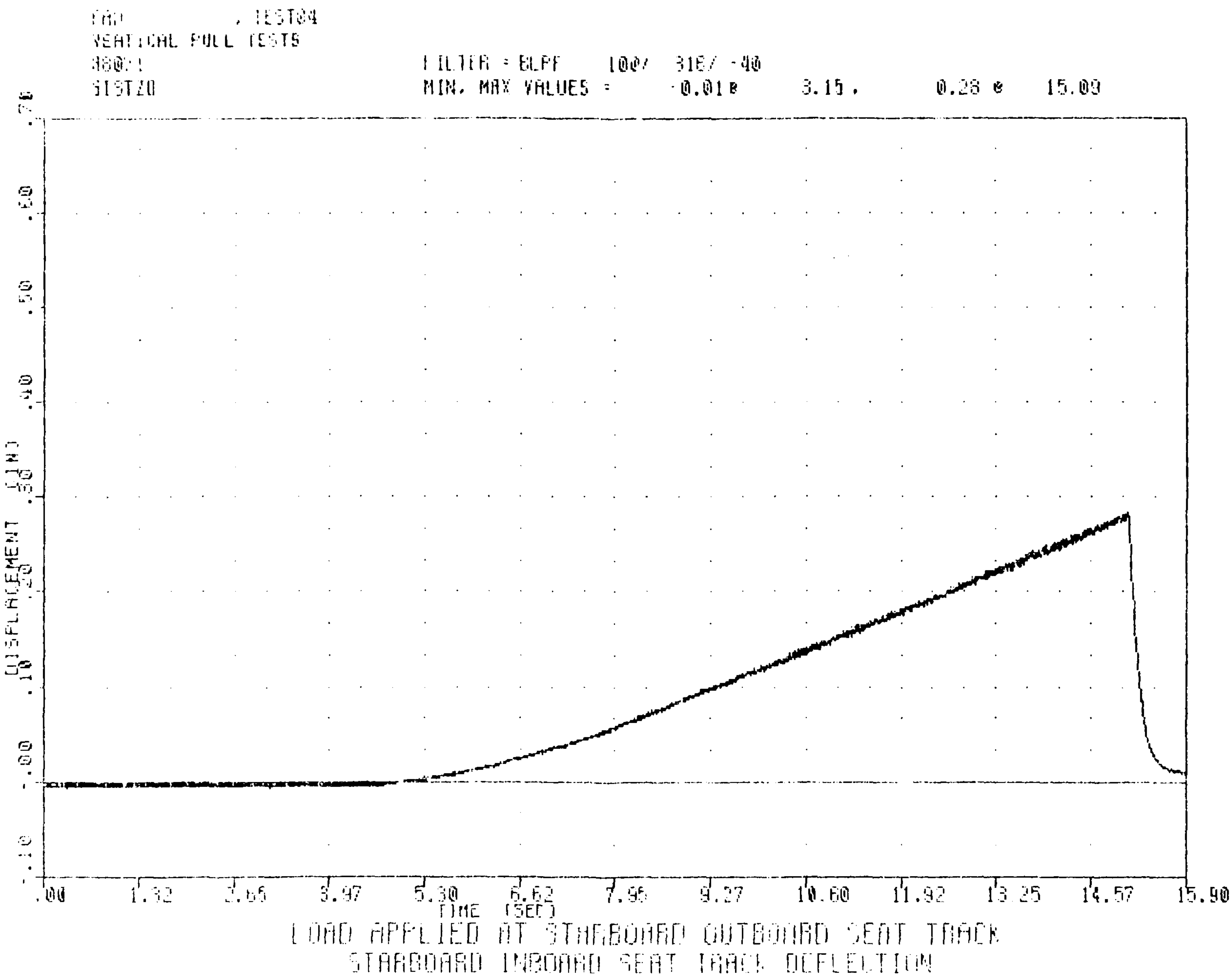
FAA , TEST04
VERTICAL PULL TESTS
86071
POSTZG

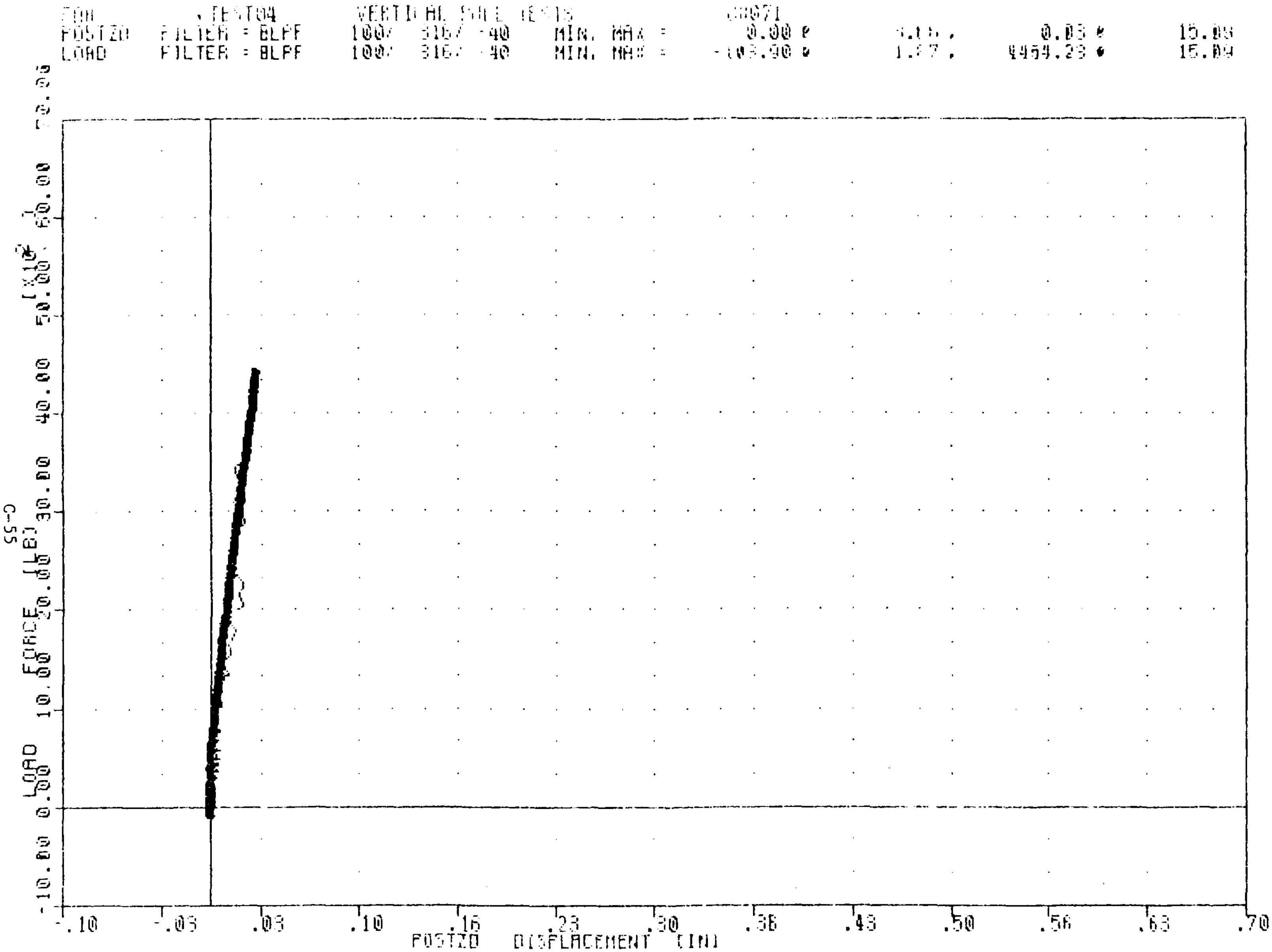
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = 0.00 @ 3.66 , 0.03 @ 15.09



LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK
PORT OUTBOARD SEAT TRACK DEFLECTION


FAA TE 109
VERTICAL PULL TESTS
880?1
PISTZB
FILTER = BLPF 100/ 316/ 40
MIN, MAX VALUES = 0.01@ 2.9?, 0.11 @ 15.10
DISPLACEMENT (IN)
.60
.50
.40
.30
.20
.10
.00
-.10
.00
1.32
2.65
3.97
5.30
6.62
7.95
9.27
10.60
11.92
13.25
14.57
15.90
TIME (SEC)
LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK
PORT INBOARD SEAT TRACK DEFLECTION

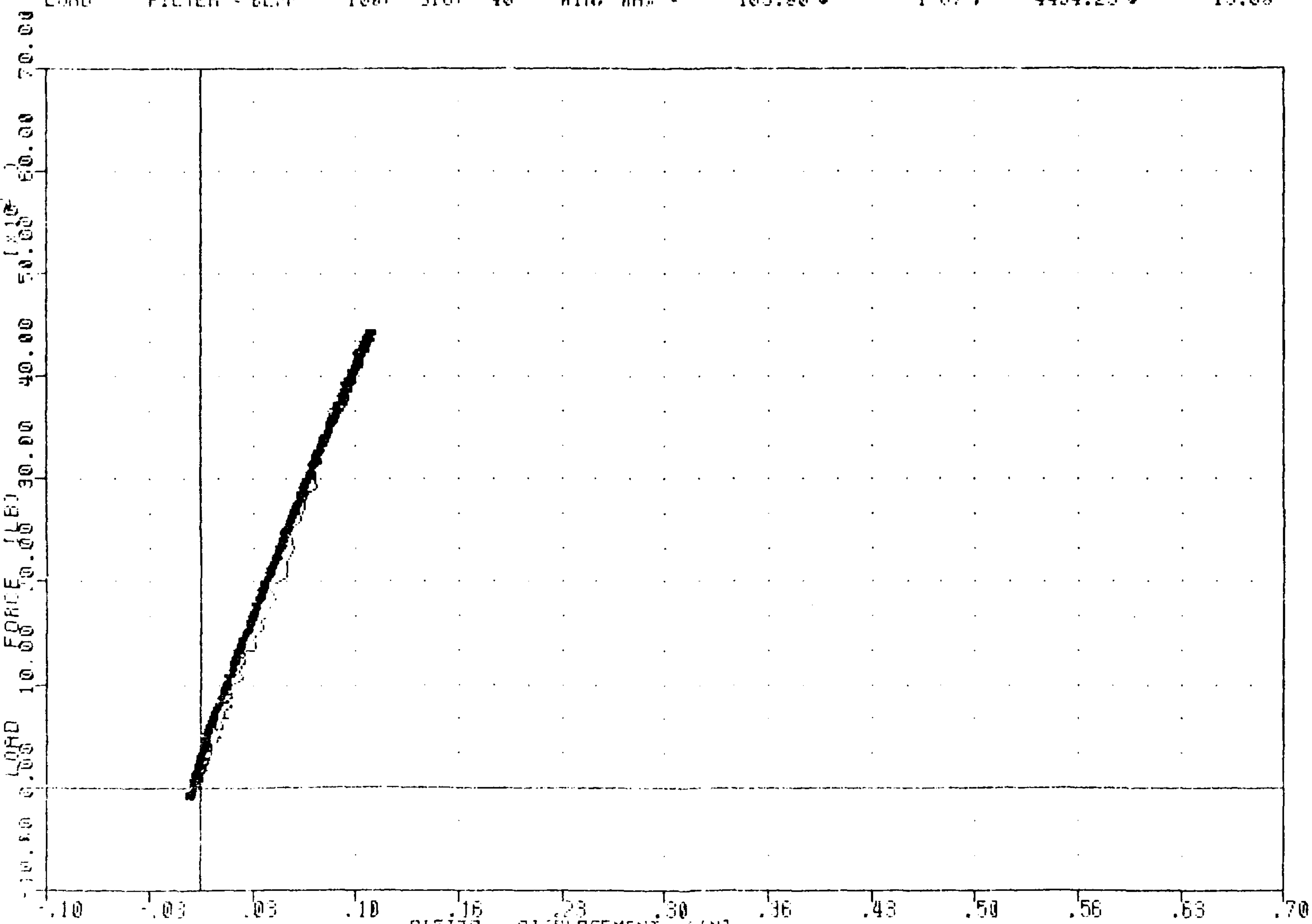

FAA , TEST04
VERTICAL PULL TESTS
880/1
SISTZ0
FILTER = BLPF 100/ 318/ -40
MIN, MAX VALUES = -0.01 @ 3.15 , 0.28 @ 15.09
DISPLACEMENT (IN)
.70
.60
.50
.40
.30
.20
.10
.00
-.10
.00
1.32
2.65
3.97
5.30
6.62
7.95
9.27
10.60
11.92
13.25
14.57
15.90
TIME (SEC)
LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK
STARBOARD INBOARD SEAT TRACK DEFLECTION



LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK

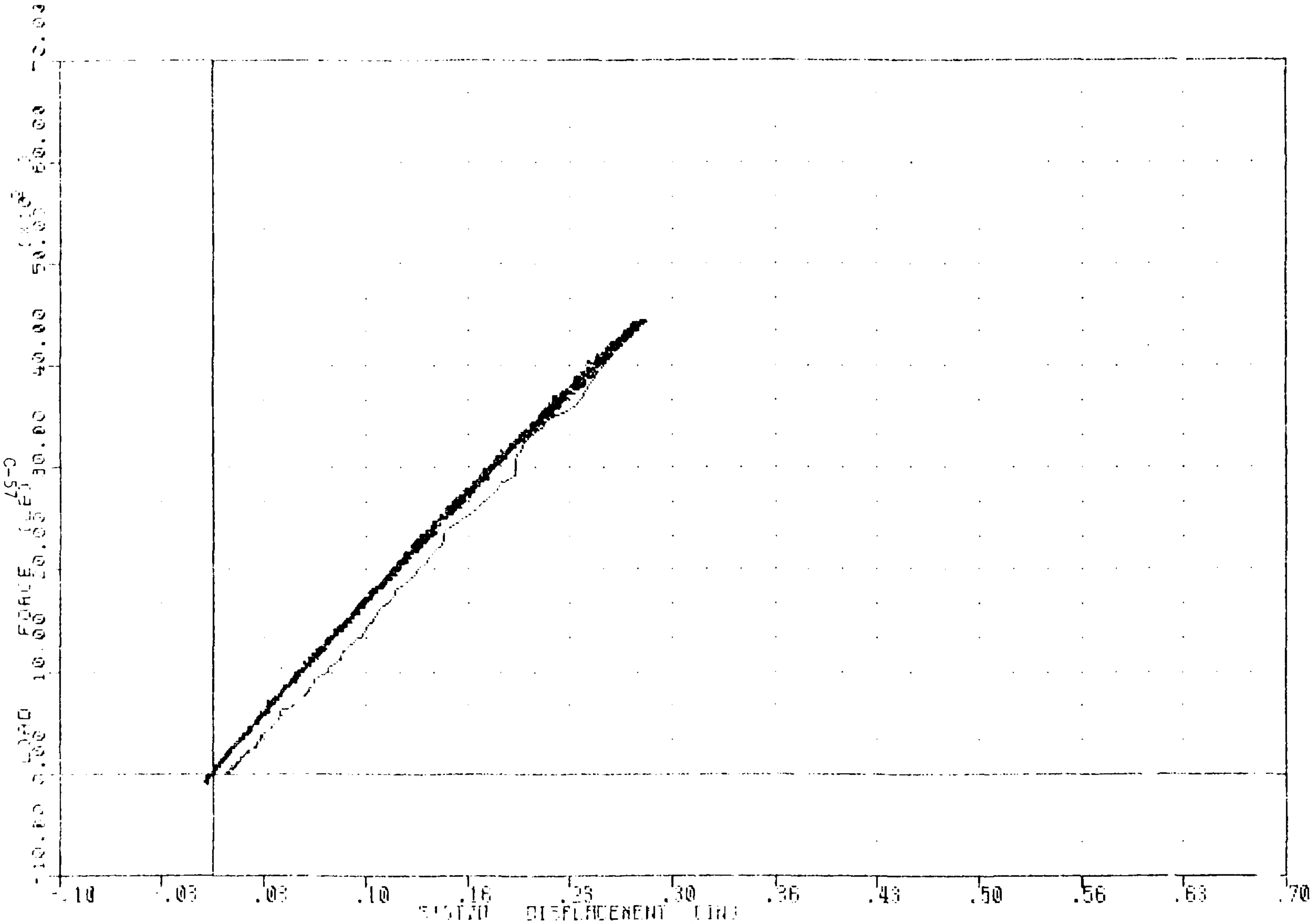
LOAD APPLIED TO SEAT TRACK VS PORT OUTBOARD SEAT TRACK DEFLECTION

FAA	.TES104	VERTICAL PULL TESTS		02071			
PISIZD	FILTER = 3LPF	100/ 316/ -40	MIN, MAX =	-0.01 @	2.92 ,	0.11 @	15.10
LOAD	FILTER = BLPF	100/ 316/ -40	MIN, MAX =	-103.90 @	1.87 ,	4454.23 @	15.09



LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK

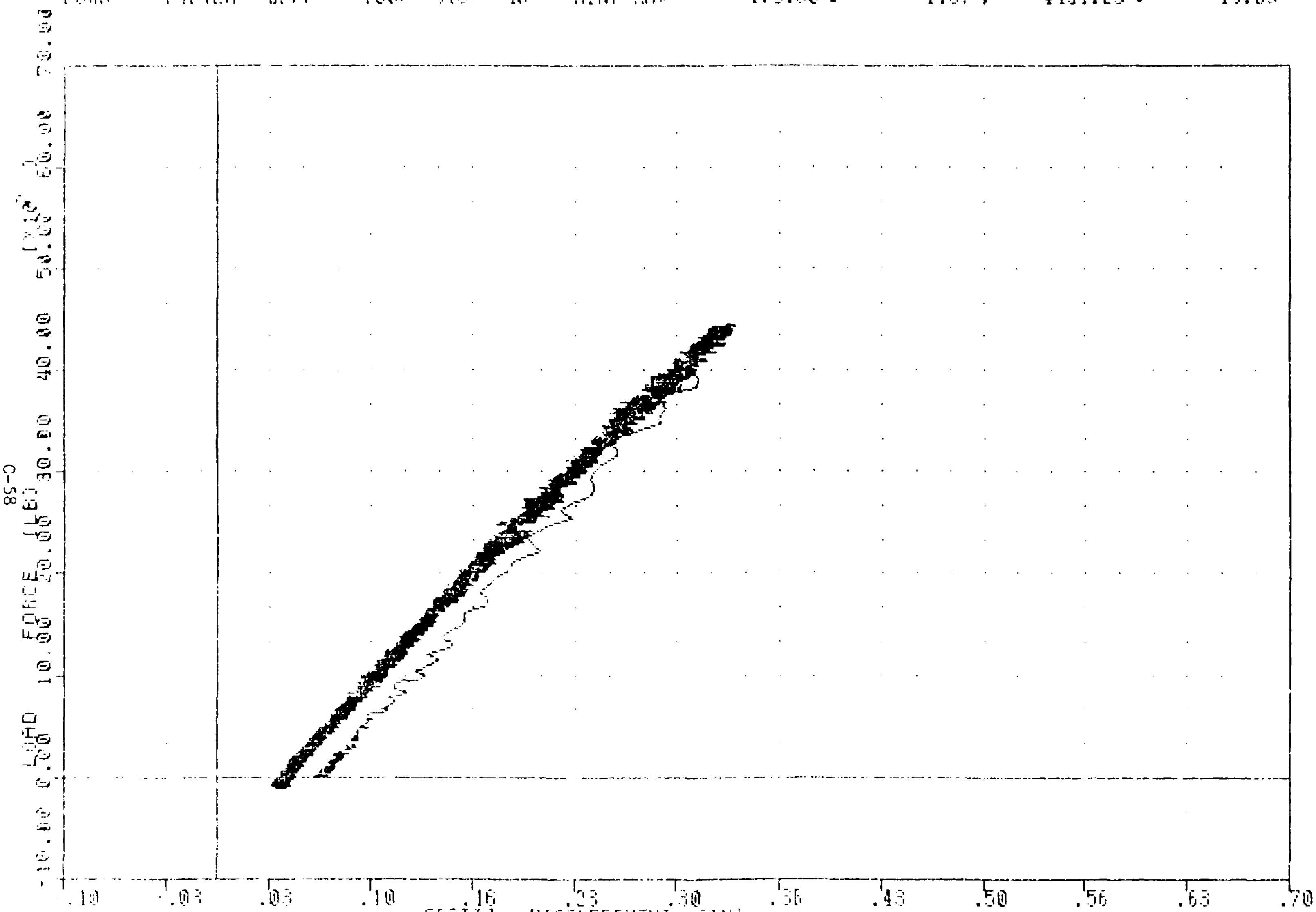
LOAD APPLIED TO SEAT TRACK VS PORT INBOARD SEAT TRACK DEFLECTION



LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK

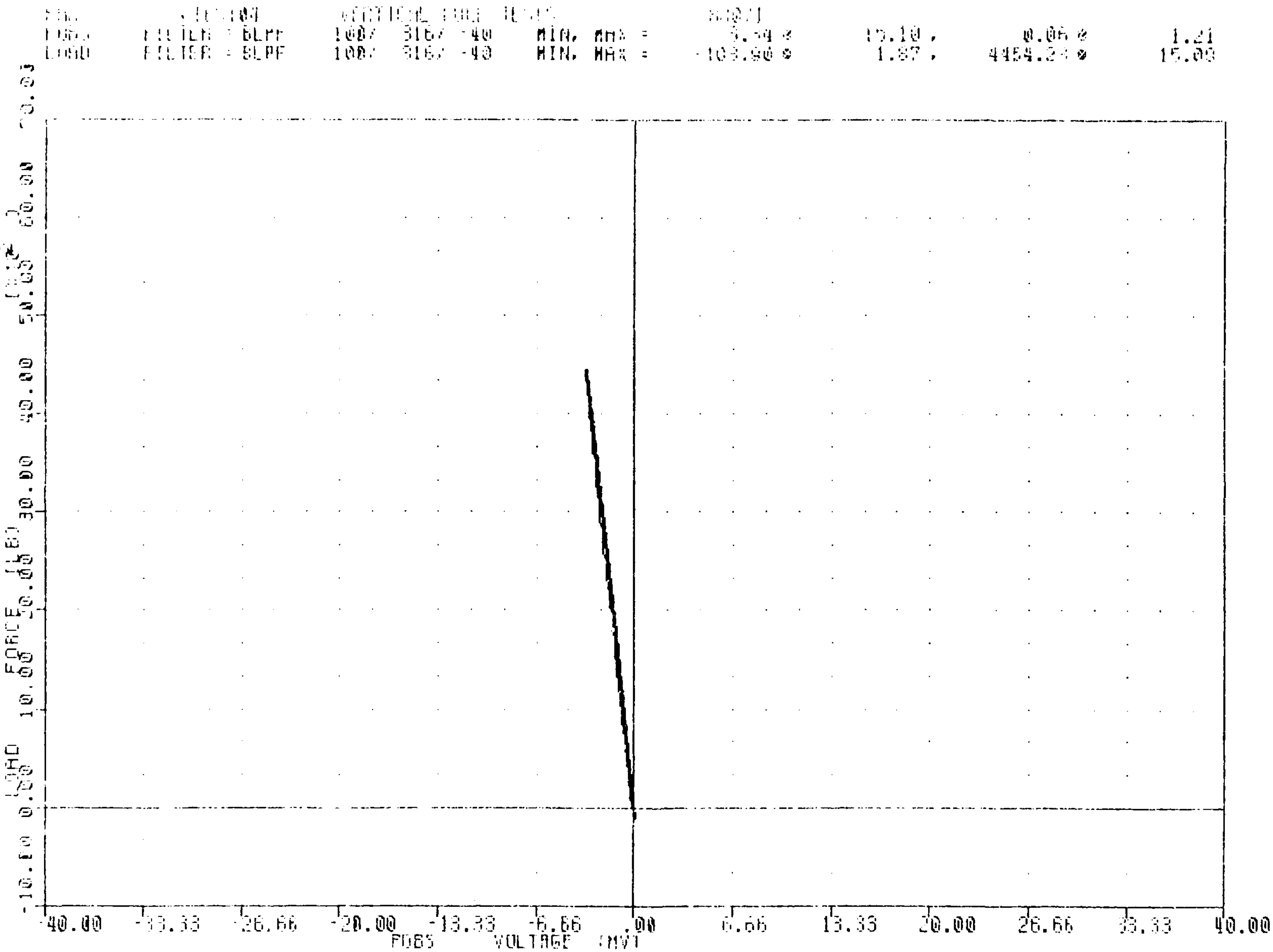
LOAD APPLIED TO SEAT TRACK VS STARBOARD INBOARD SEAT TRACK DEFLECTION

MIN. MAX = 0.03 @ 0.57 , 0.54 @ 15.06
MIN. MAX = -163.90 @ 1.87 , 4454.23 @ 15.09



LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK

LOAD APPLIED TO SEAT TRACK VS STARBOARD OUTBOARD SEAT TRACK DEFLECTION

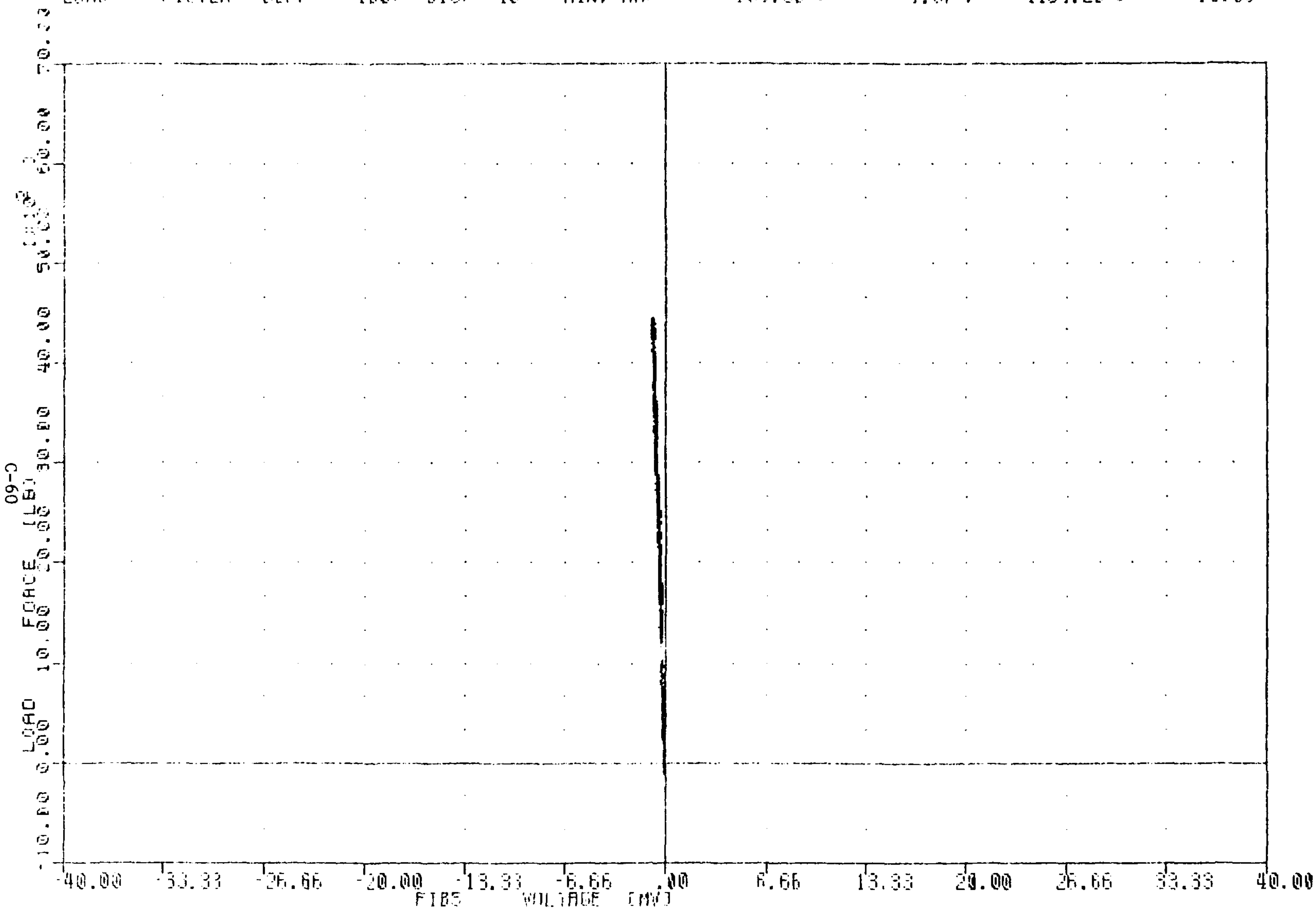


LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK
LOAD APPLIED TO SEAT TRACK VS PORT OUTBOARD BEAM STRAIN

TFS104 VERTICAL PULL TESTS CH071

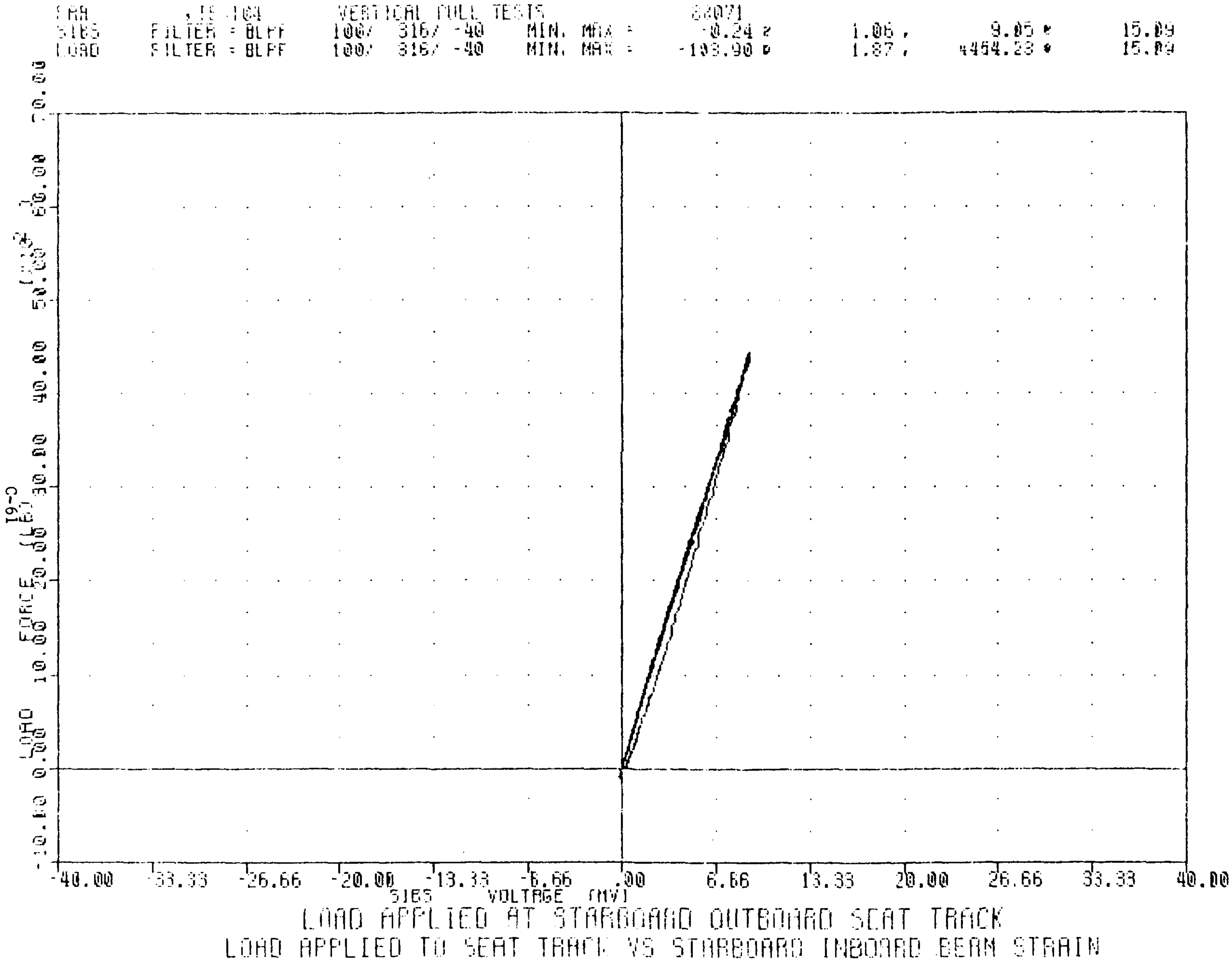
FIBS FILTER : BLPF 100/ 316/ -40 MIN, MAX = -0.94 @ 15.05 , 0.00 @ 0.14

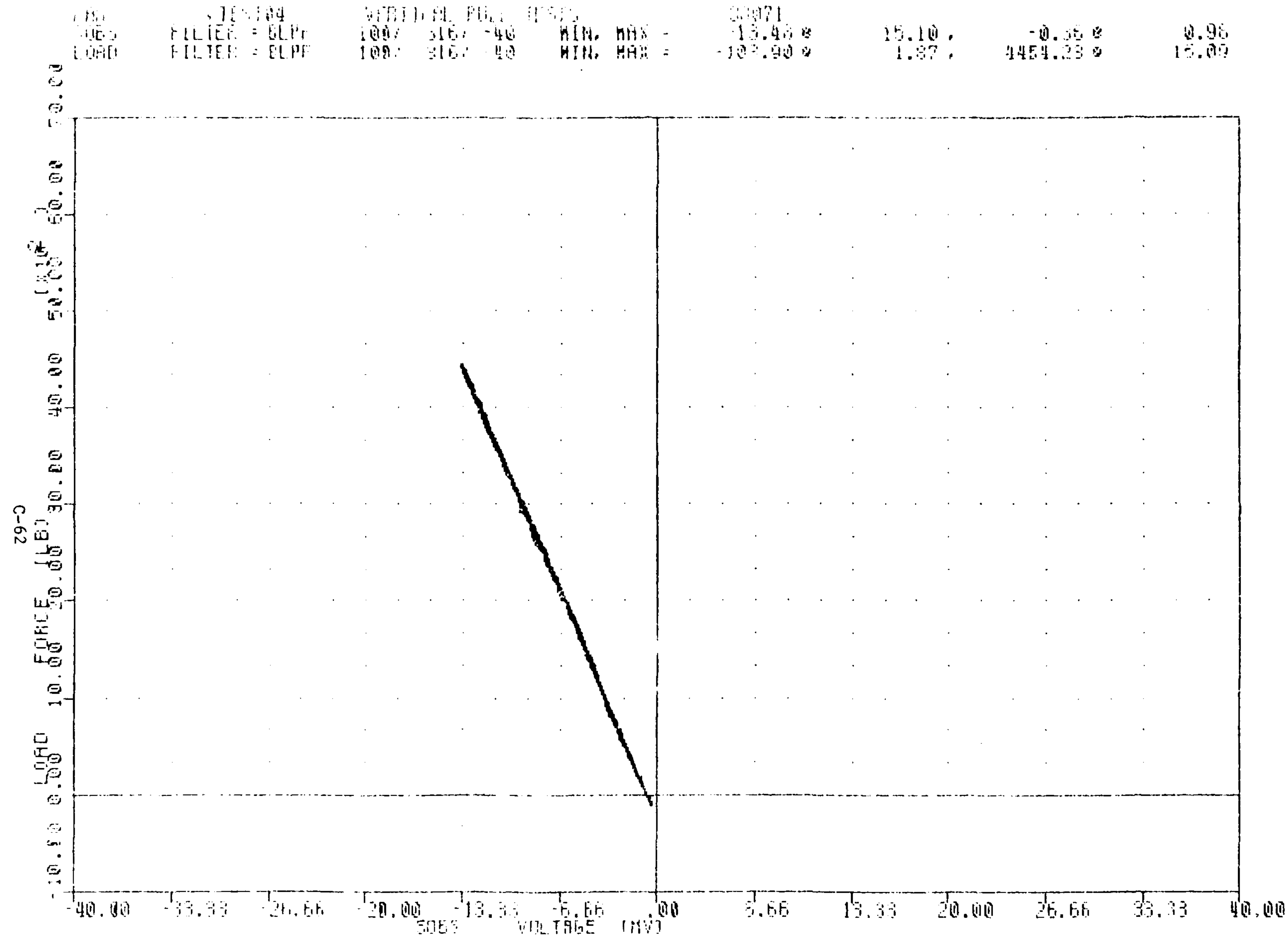
LOAD FILTER : BLPF 100/ 316/ -40 MIN, MAX = -103.90 @ 1.87 , 4454.23 @ 15.09



LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK

LOAD APPLIED TO SEAT TRACK VS PORT INBOARD BEAM STRAIN

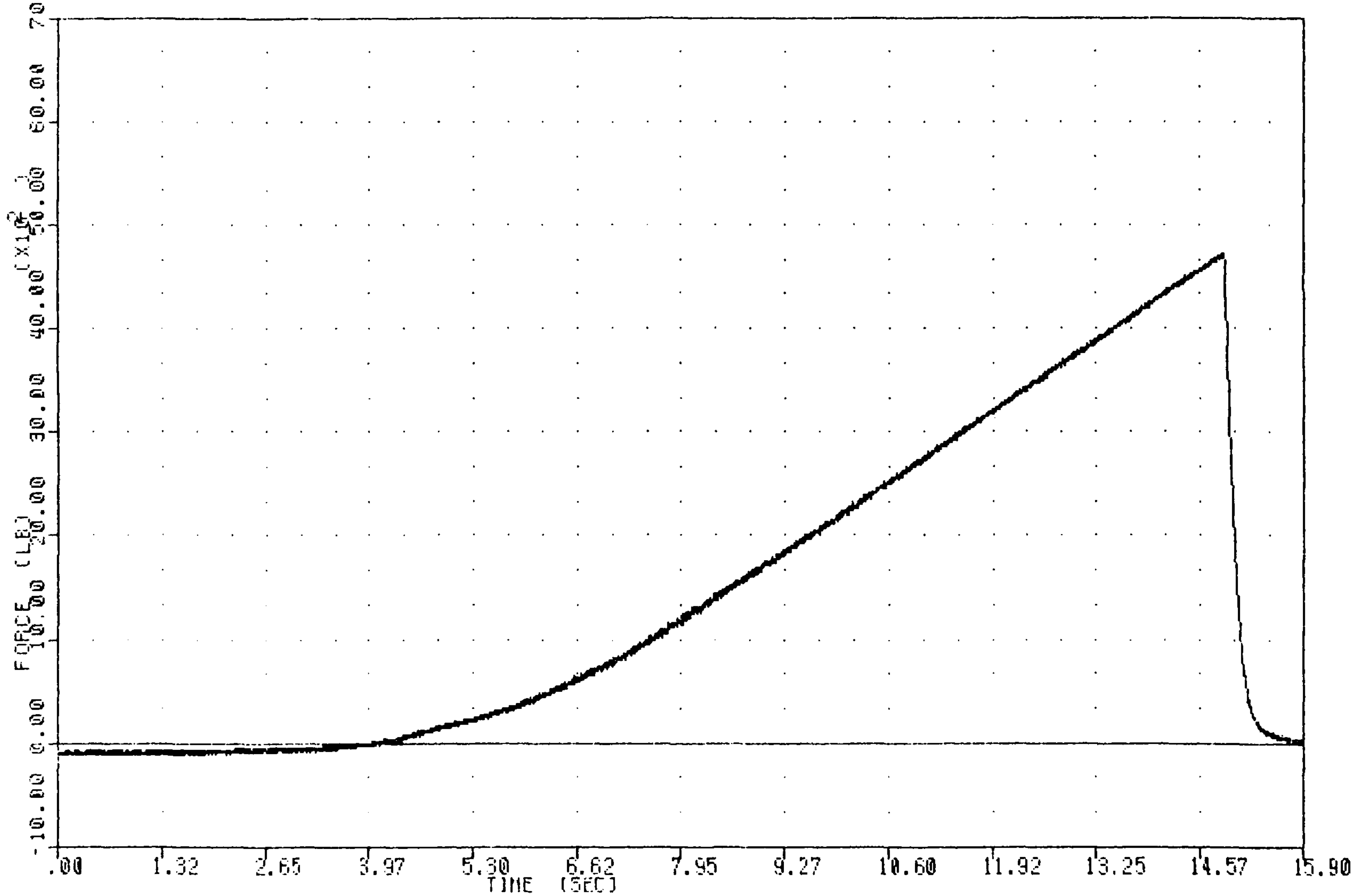

FAA .JS 104 VERTICAL PULL TESTS 82071
SIBS FILTER = BLFF 100/ 316/ -40 MIN, MAX = -0.24 @ 1.06 , 9.05 @ 15.09
LOAD FILTER = BLFF 100/ 316/ -40 MIN, MAX = -103.90 @ 1.87 , 4454.23 @ 15.09
LOAD FORCE (LBF) (x10^2)
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
-40.00
-33.33
-26.66
-20.00
-13.33
-6.66
.00
6.66
13.33
20.00
26.66
33.33
40.00
SIBS VOLTAGE (MV)
LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK
LOAD APPLIED TO SEAT TRACK VS STARBOARD INBOARD BEAM STRAIN



LOAD APPLIED AT STARBOARD OUTBOARD SEAT TRACK
LOAD APPLIED TO SEAT TRACK VS STARBOARD OUTBOARD BEAM STRAIN

FAA , TEST05
VERTICAL PULL TESTS
88071
LOAD

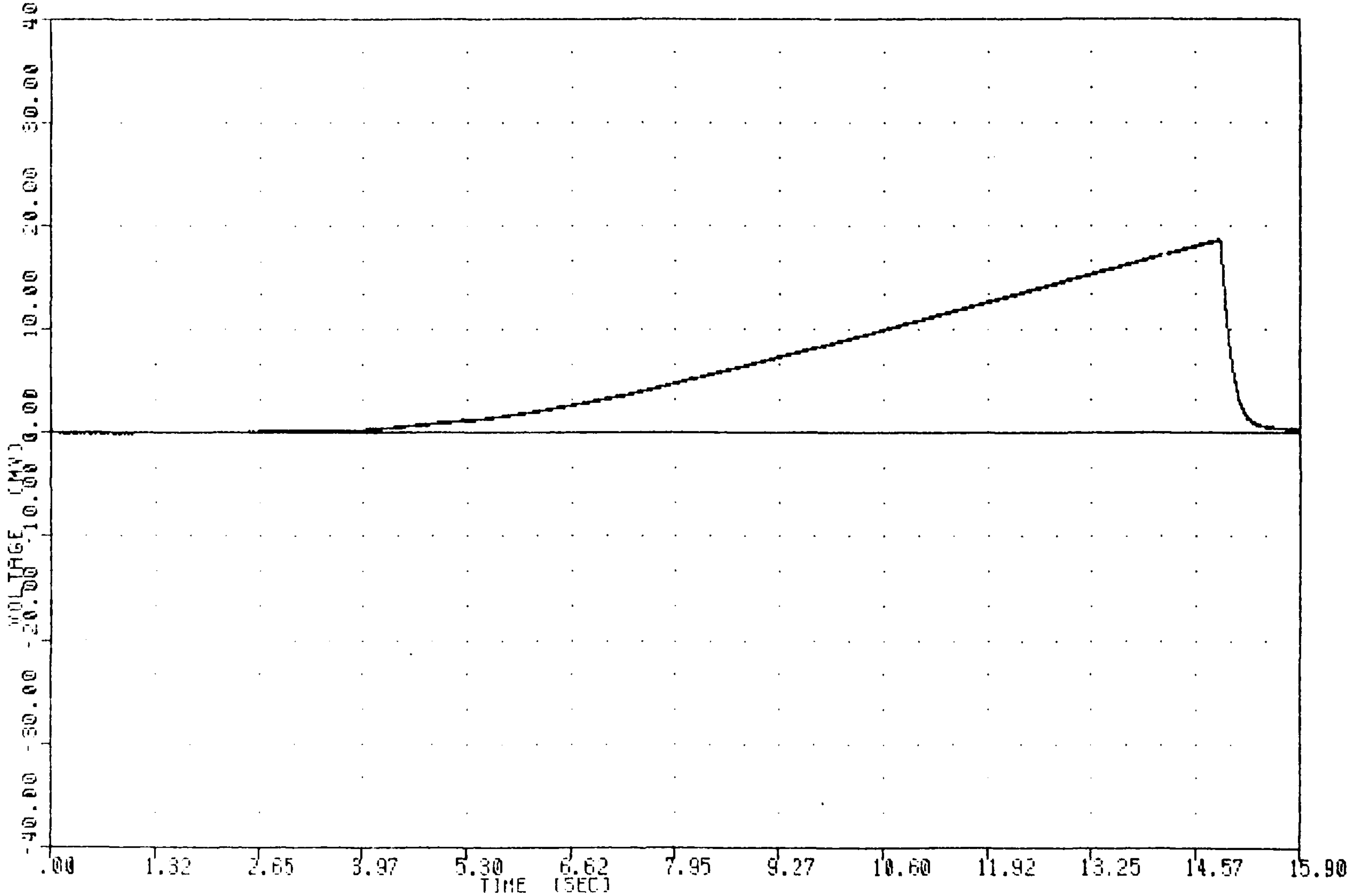
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -120.95 @ 0.38 , 4730.23 @ 14.88



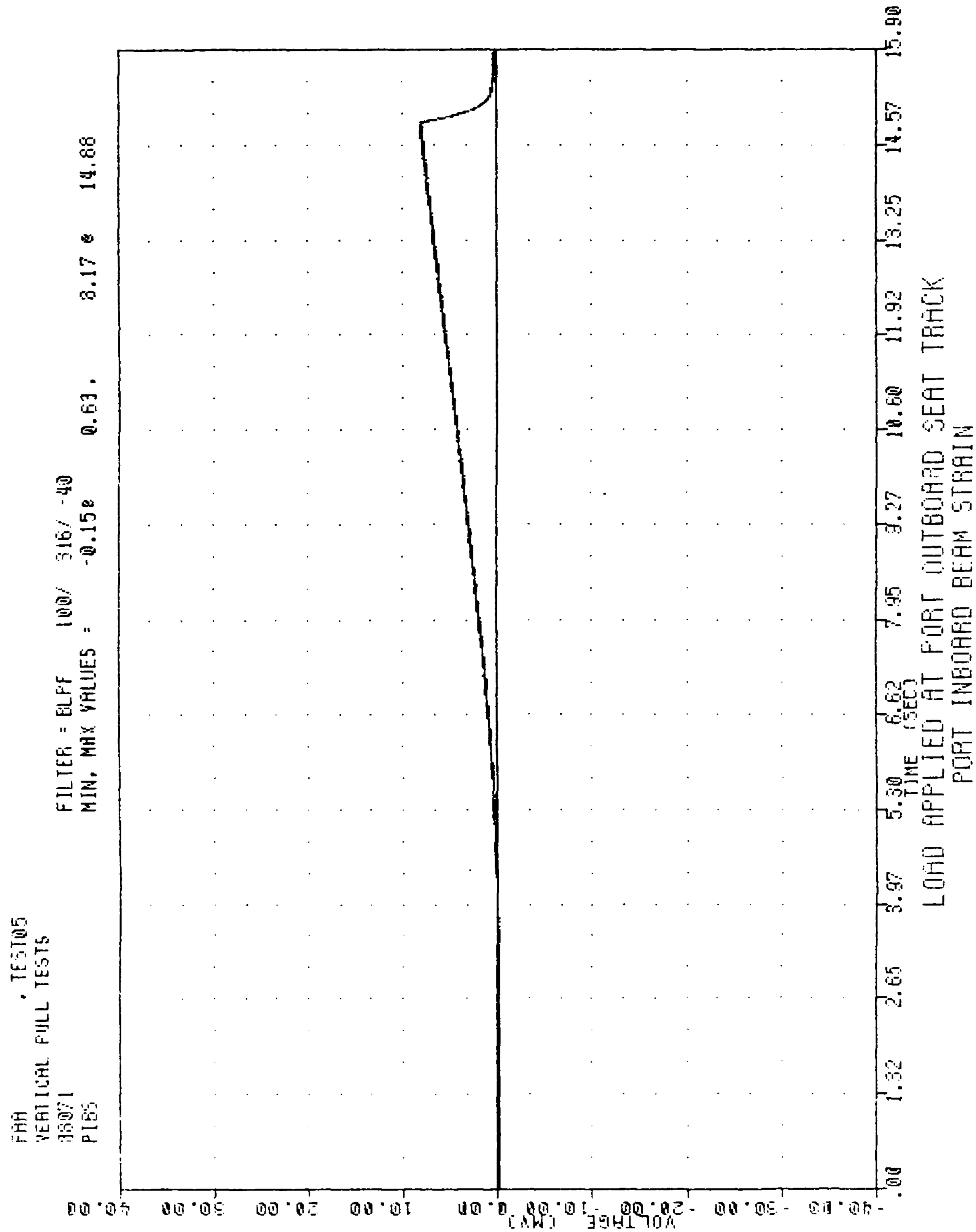
LOAD APPLIED AT PORT OUTBOARD SEAT TRACK
LOAD APPLIED TO SEAT TRACK

FAA , TEST05
VERTICAL PULL TESTS
85071
P085

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.06 @ 0.93 , 18.70 @ 14.88

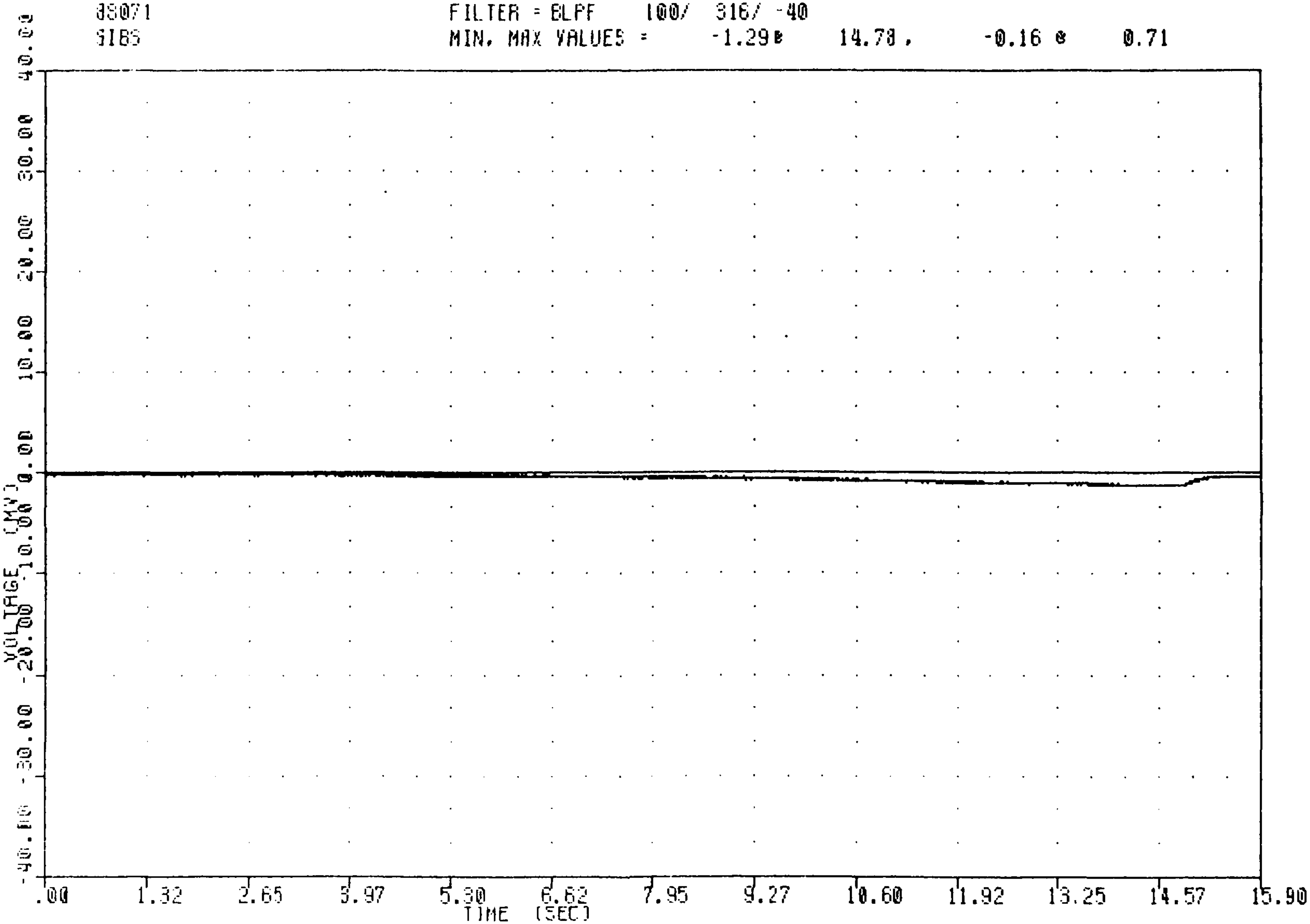


LOAD APPLIED AT PORT OUTBOARD SEAT TRACK
PORT OUTBOARD BEAM STRAIN


FAA
VERTICAL PULL TESTS
, TEST05
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.15 @ 0.63, 8.17 @ 14.88
.00
1.32
2.65
3.97
5.30
6.62
7.95
9.27
10.60
11.92
13.25
14.57
15.90
TIME (SEC)
LOAD APPLIED AT PORT OUTBOARD SEAT TRACK
PORT INBOARD BEAM STRAIN
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
VOLTAGE (MV)

FAA , TEST05
VERTICAL PULL TESTS
88071
SIBS

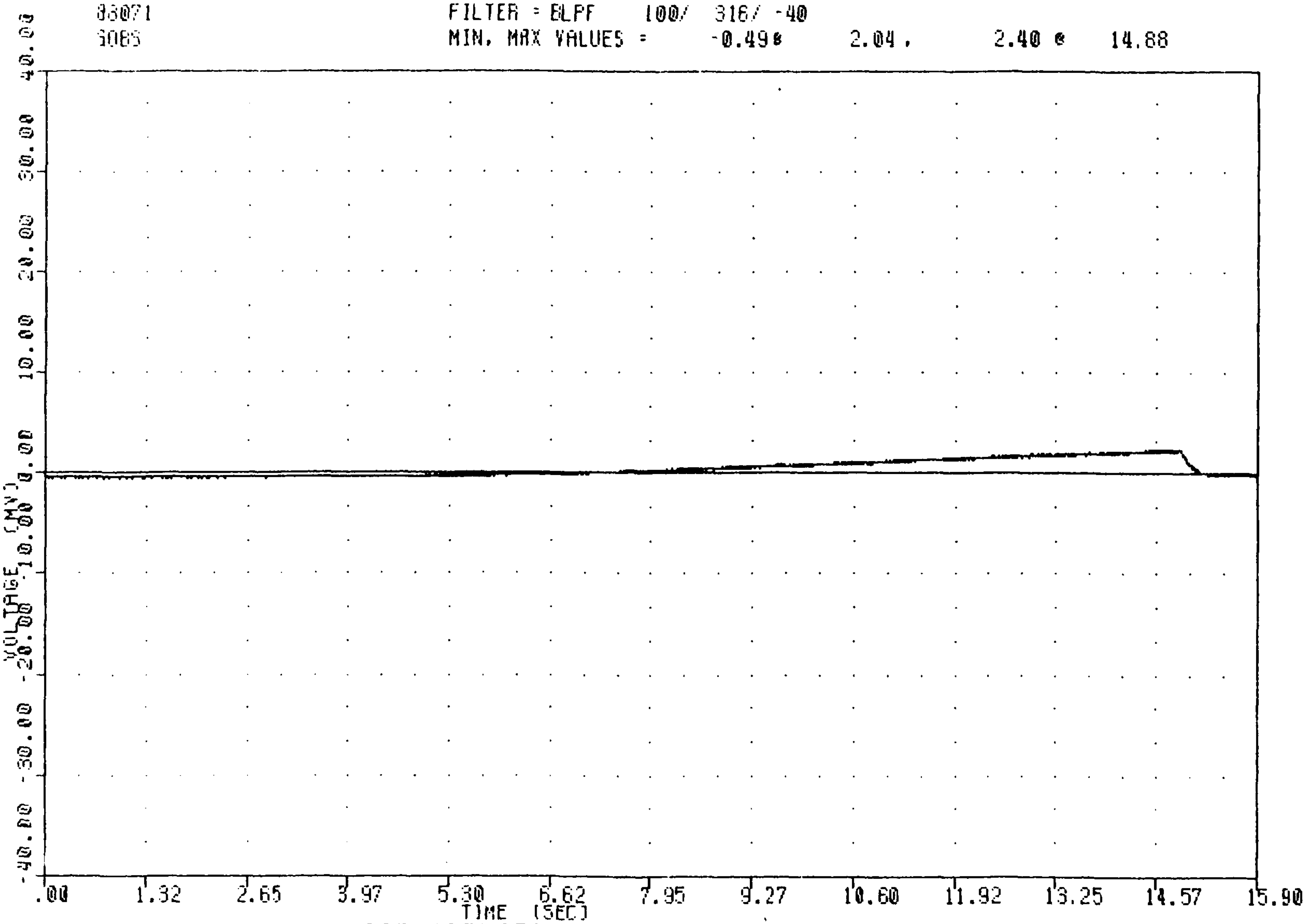
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -1.29 @ 14.78 , -0.16 @ 0.71



LOAD APPLIED AT PORT OUTBOARD SEAT TRACK
STARBOARD INBOARD BEAM STRAIN

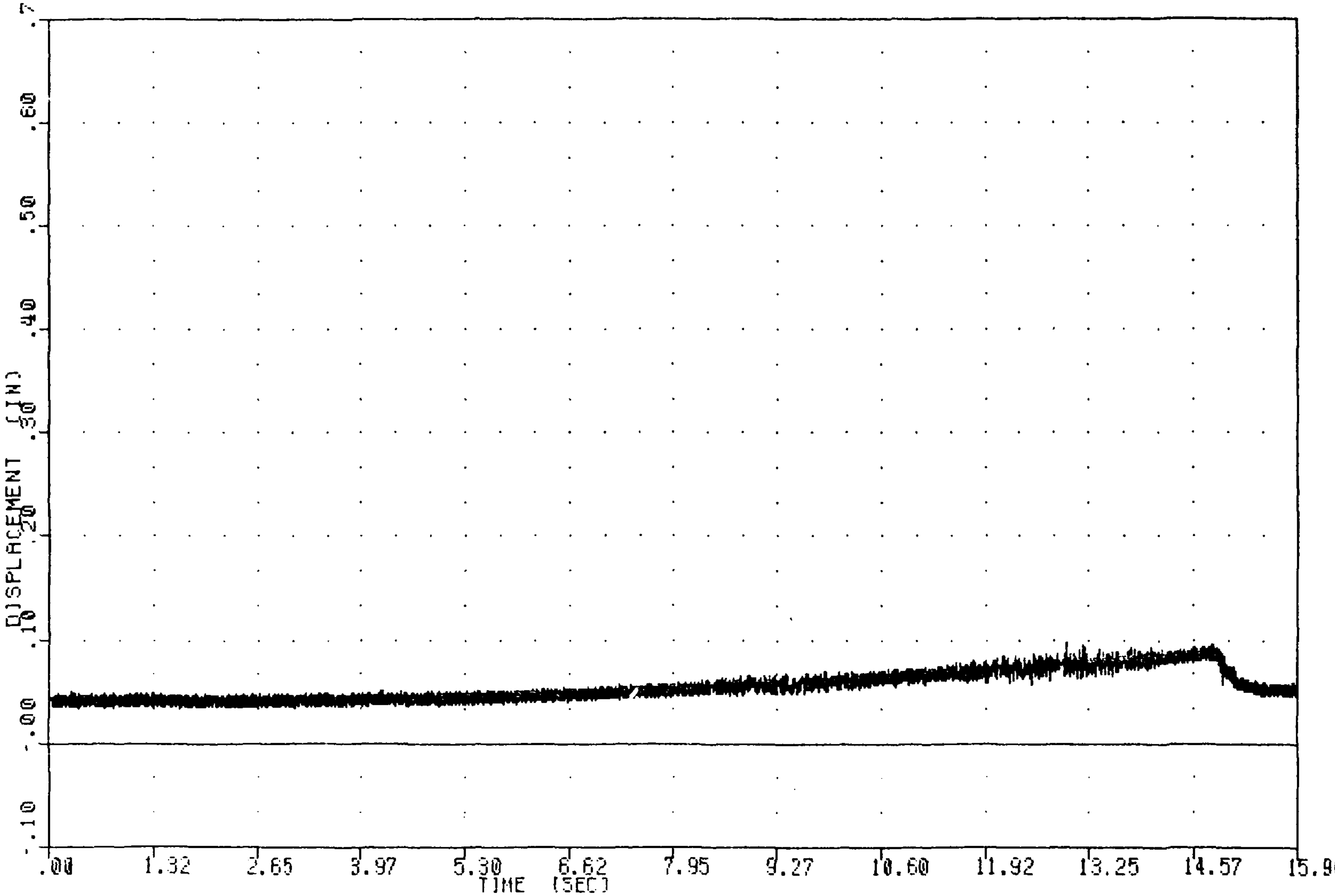
FAA , TEST05
VERTICAL PULL TESTS
88071
5085

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -0.49 @ 2.04 , 2.40 @ 14.88



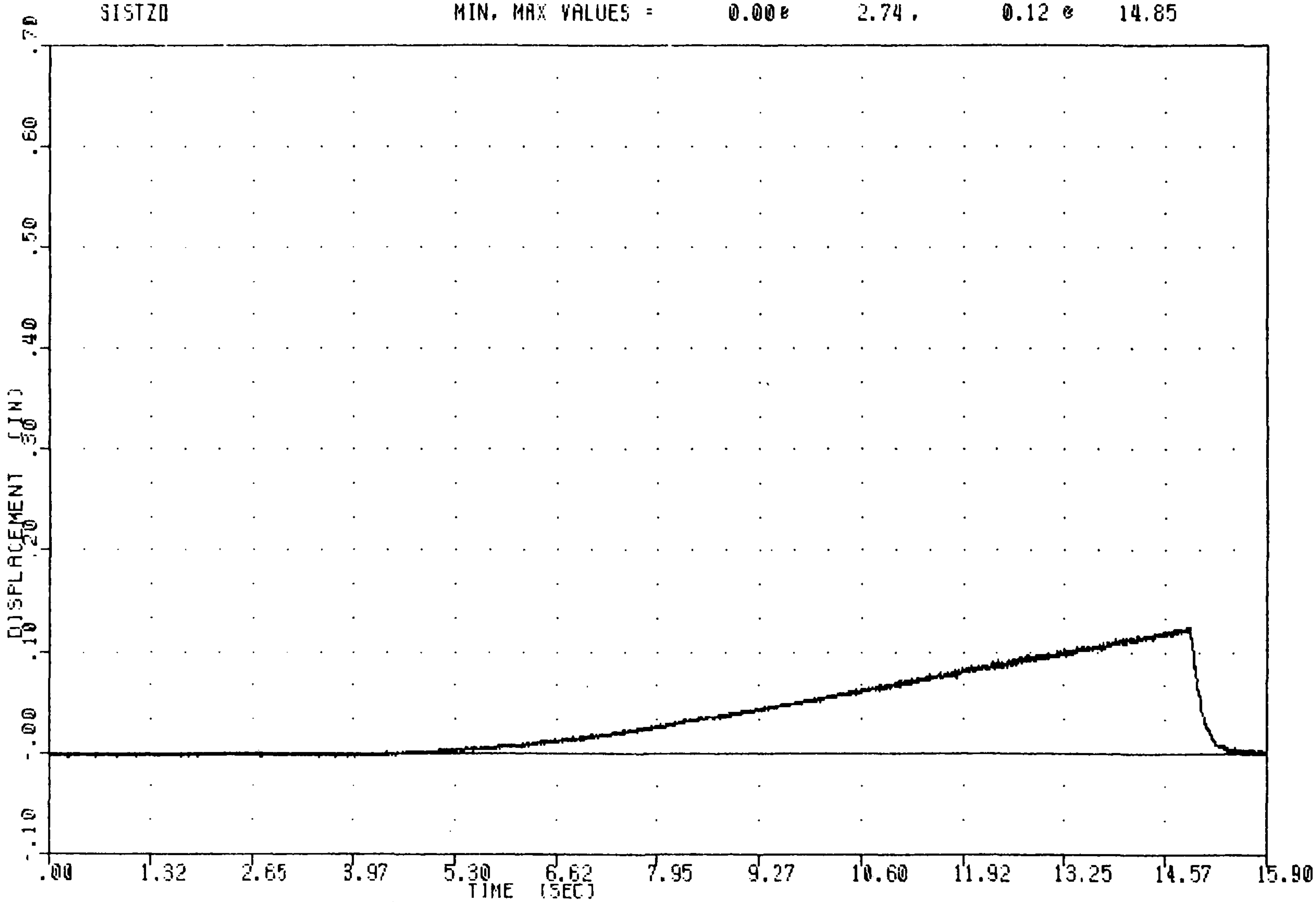
LOAD APPLIED AT PORT OUTBOARD SEAT TRACK
STARBOARD OUTBOARD BEAM STRAIN

FAA , TEST05
VERTICAL PULL TESTS
88071 FILTER = BLPF 100/ 316/ -40
SOSTZD MIN. MAX VALUES = 0.03 @ 0.70 , 0.10 @ 12.95

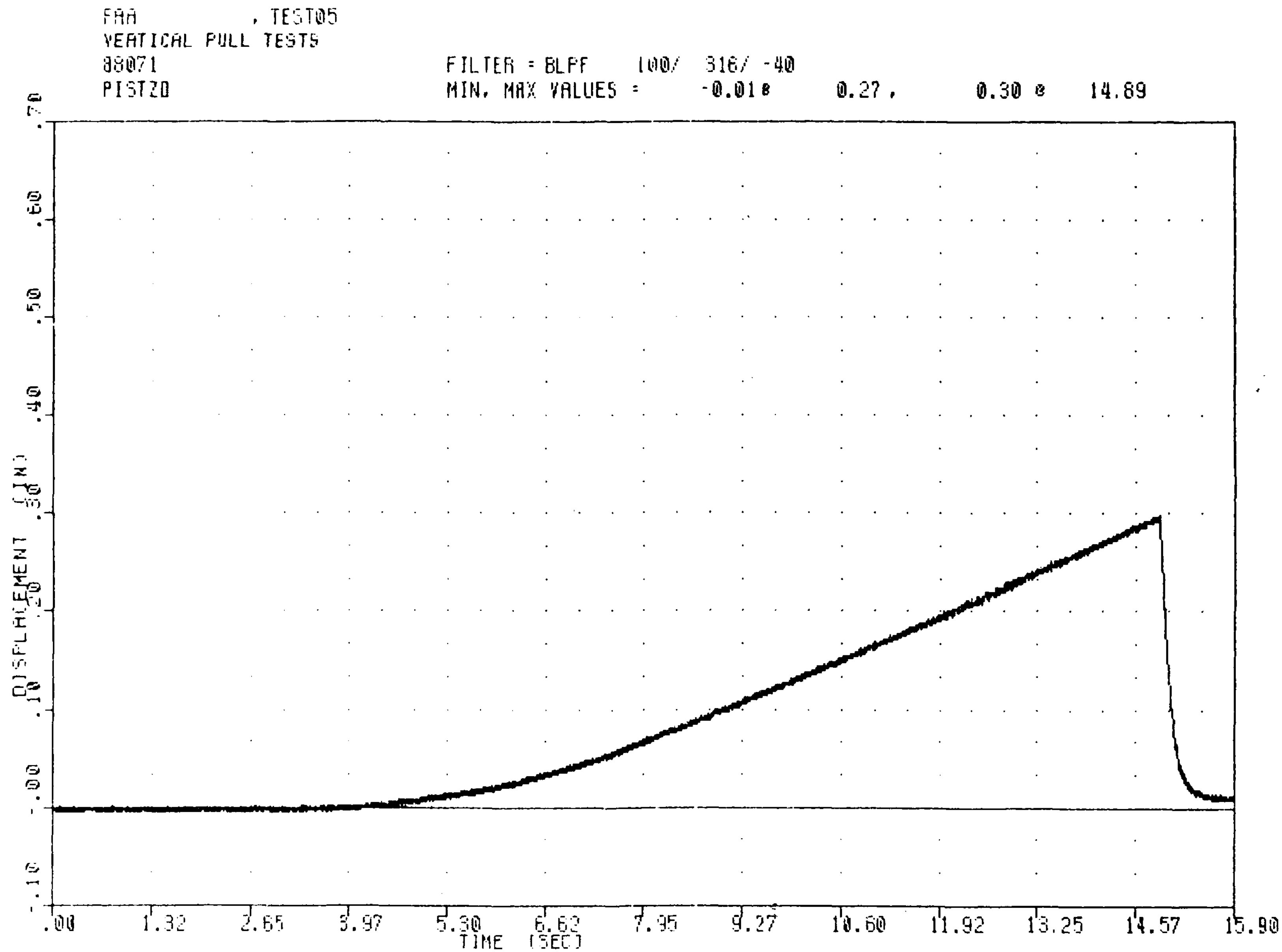


LOAD APPLIED AT PORT OUTBOARD SEAT TRACK
STARBOARD OUTBOARD SEAT TRACK DEFLECTION

FAA , TEST05
VERTICAL PULL TESTS
88071 FILTER = BLPF 100/ 316/ -40
SISTZD MIN, MAX VALUES = 0.00 @ 2.74 , 0.12 @ 14.85



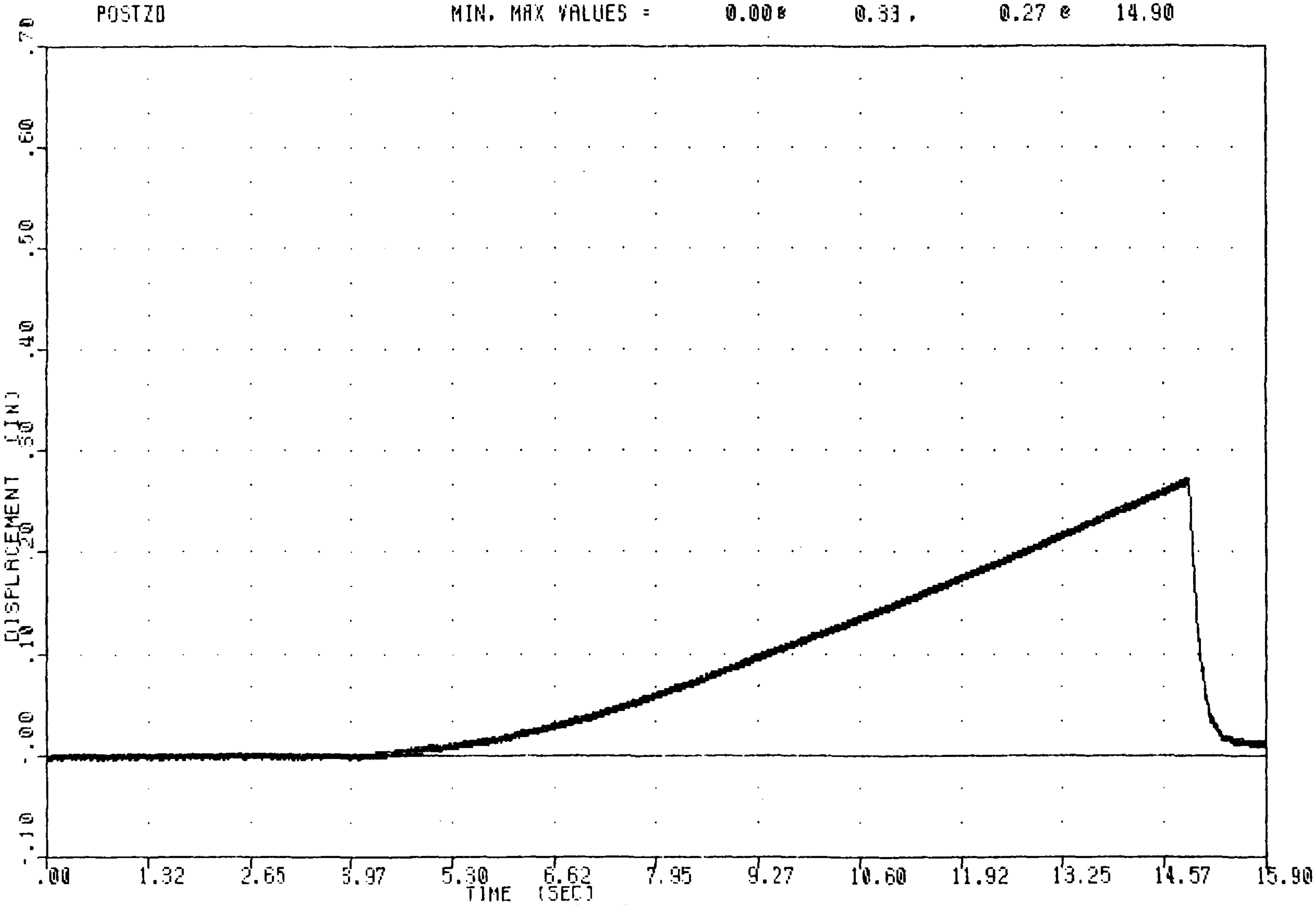
LOAD APPLIED AT PORT OUTBOARD SEAT TRACK
STARBOARD INBOARD SEAT TRACK DEFLECTION



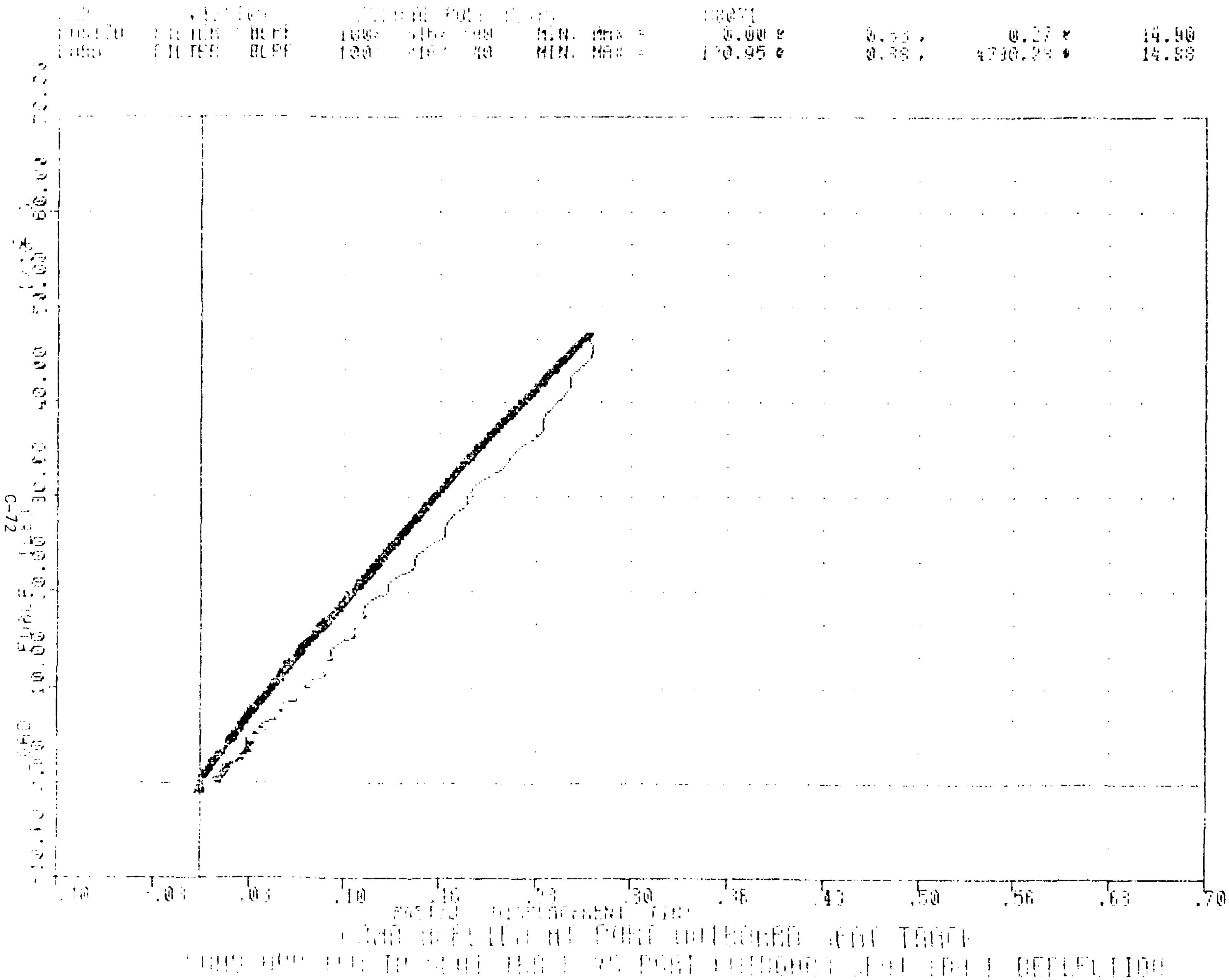
LOAD APPLIED AT PORT OUTBOARD SEAT TRACK
PORT INBOARD SEAT TRACK DEFLECTION

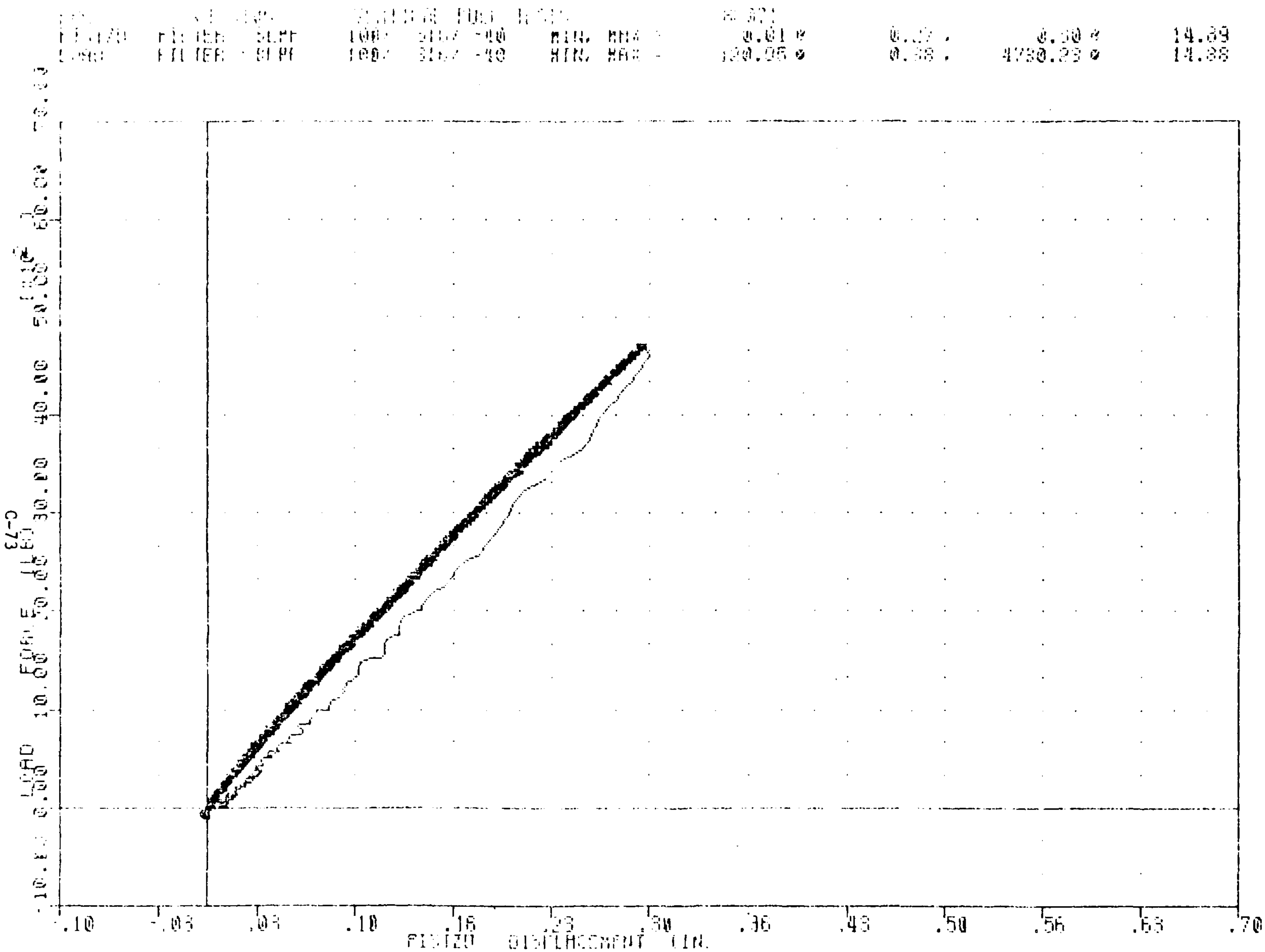
FAA , TEST05
VERTICAL PULL TESTS
38071
POSTZD

FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = 0.00 @ 0.33 , 0.27 @ 14.90



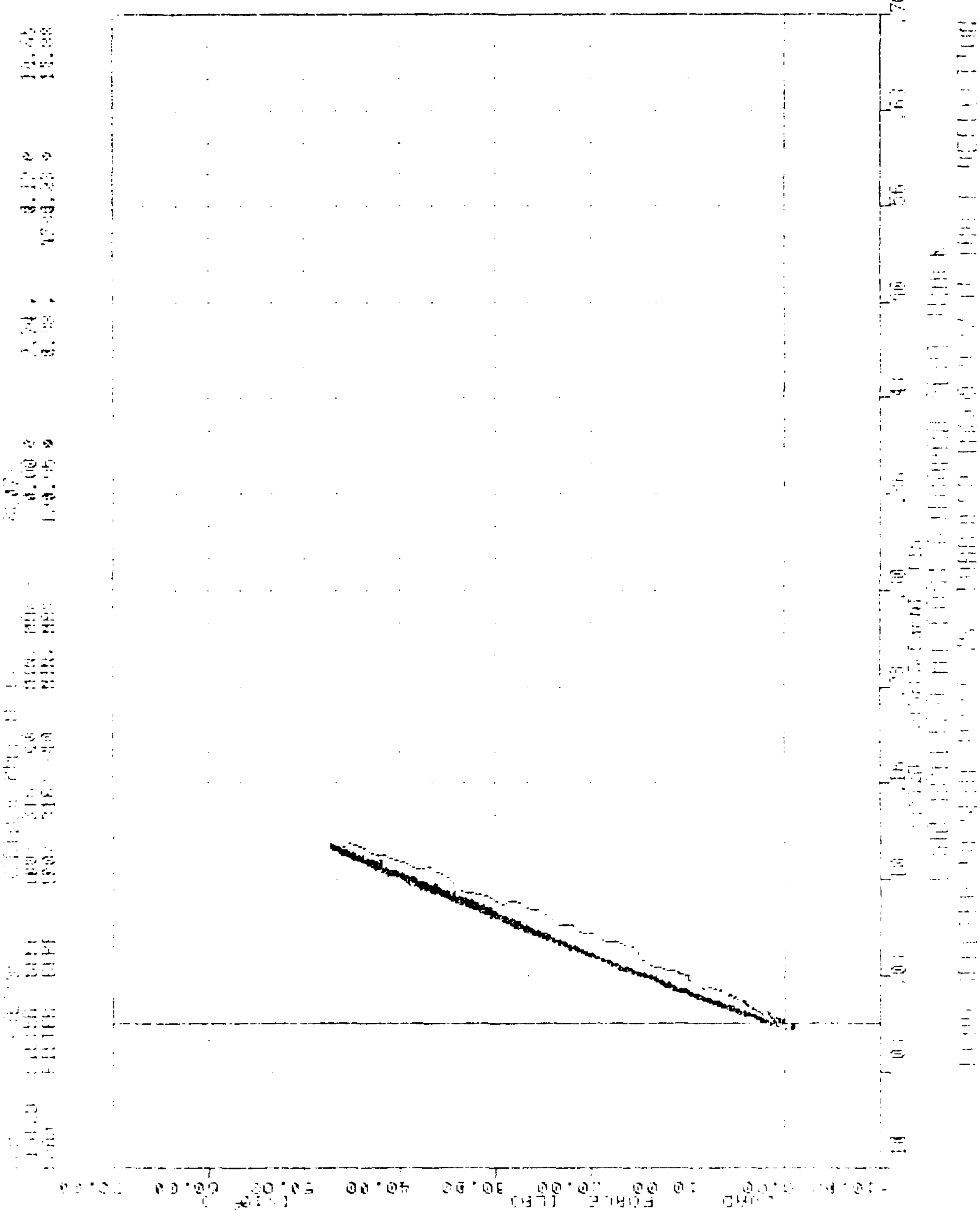
LOAD APPLIED AT PORT OUTBOARD SEAT TRACK
PORT OUTBOARD SEAT TRACK DEFLECTION

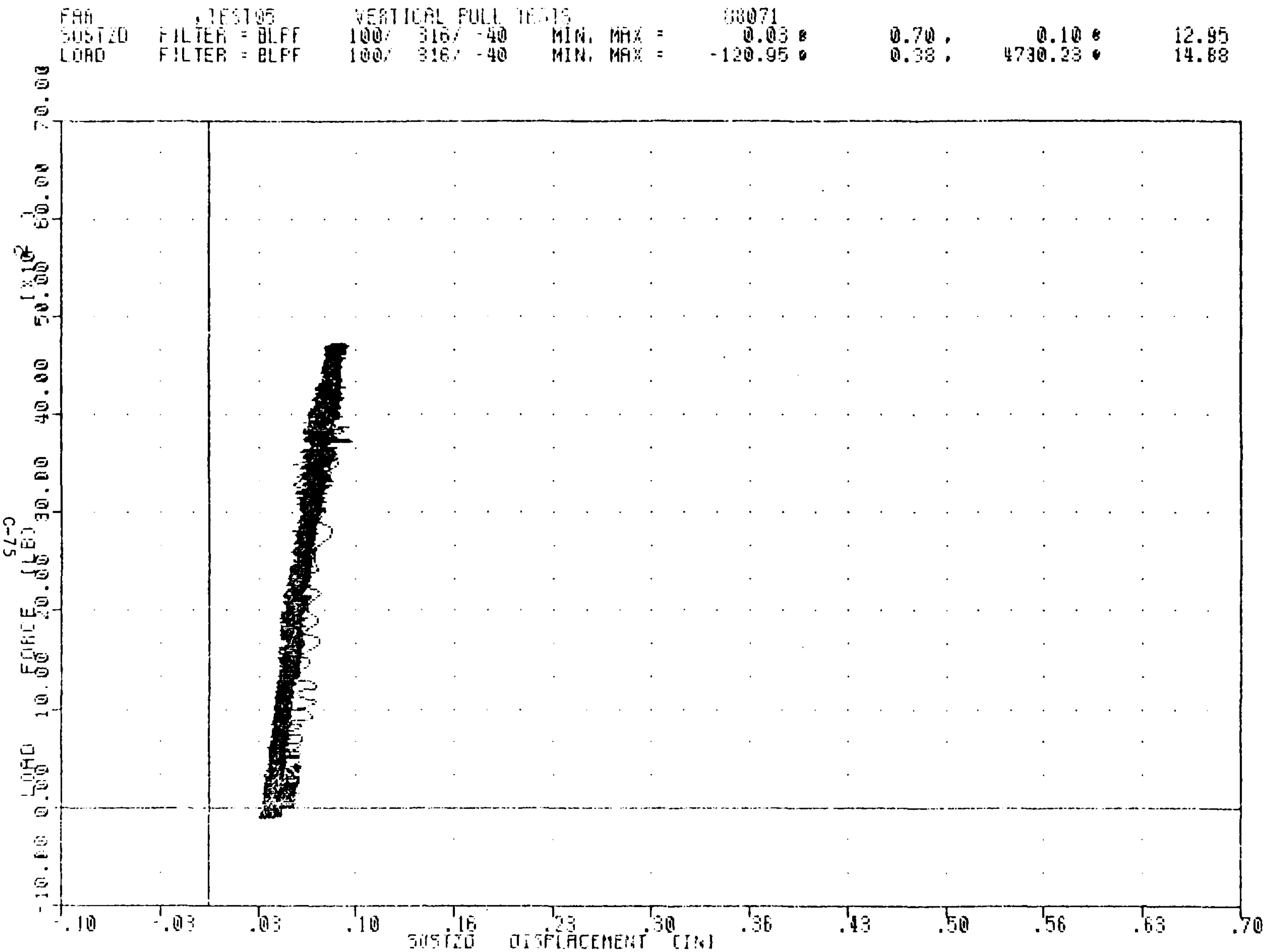

MIN. MAX
0.00
170.95
0.27
4730.23
14.90
14.88
.00
.03
.10
.30
.36
.43
.50
.56
.63
.70
10.00
30.00
40.00
60.00



LOAD APPLIED AT PORT OUTBOARD SEAT TRACK

LOAD APPLIED TO SEAT TRACK VS PORT INBOARD SEAT TRACK DEFLECTION

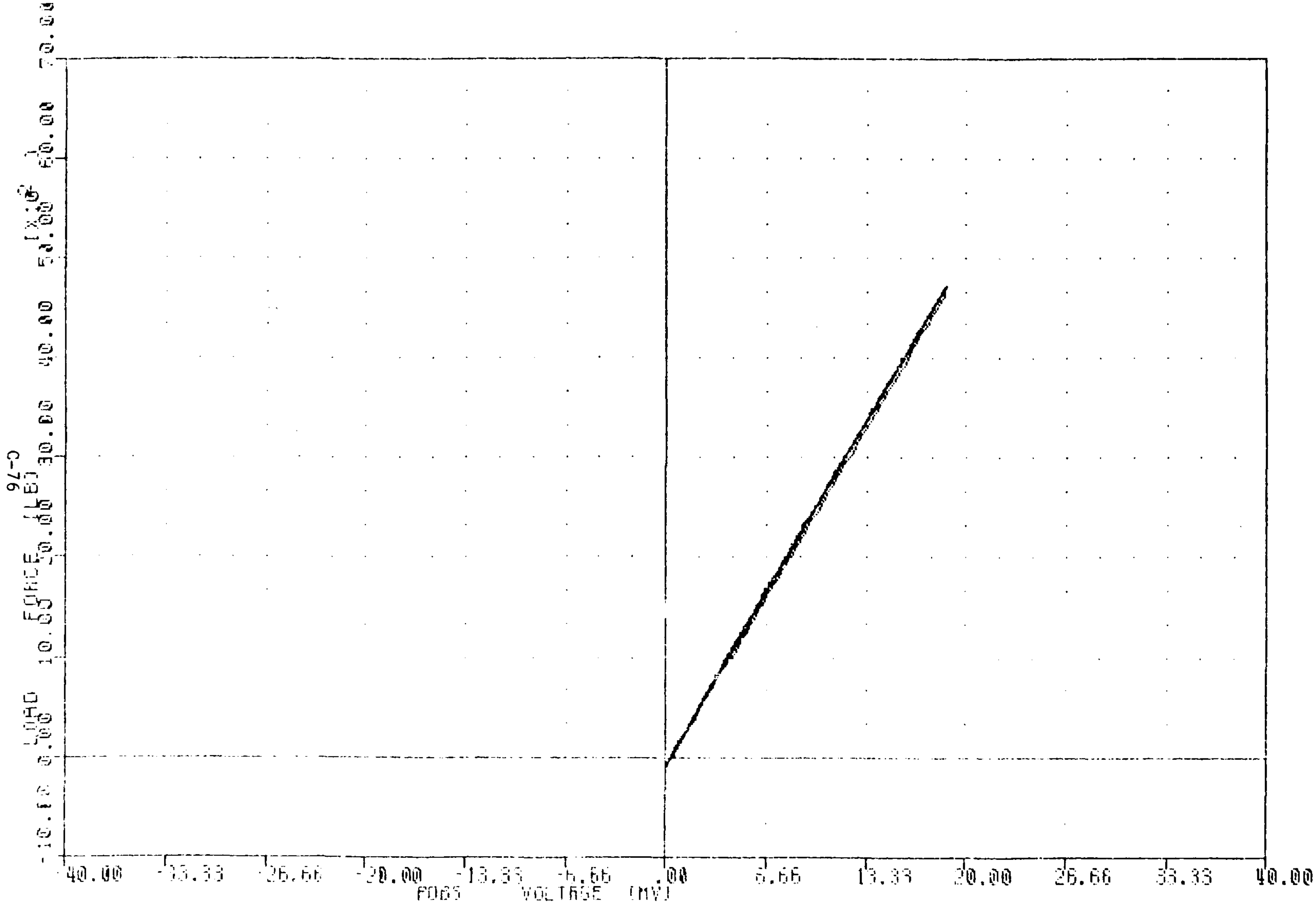




LOAD APPLIED AT PORT OUTBOARD SEAT TRACK

LOAD APPLIED TO SEAT TRACK VS STARBOARD OUTBOARD SEAT TRACK DEFLECTION

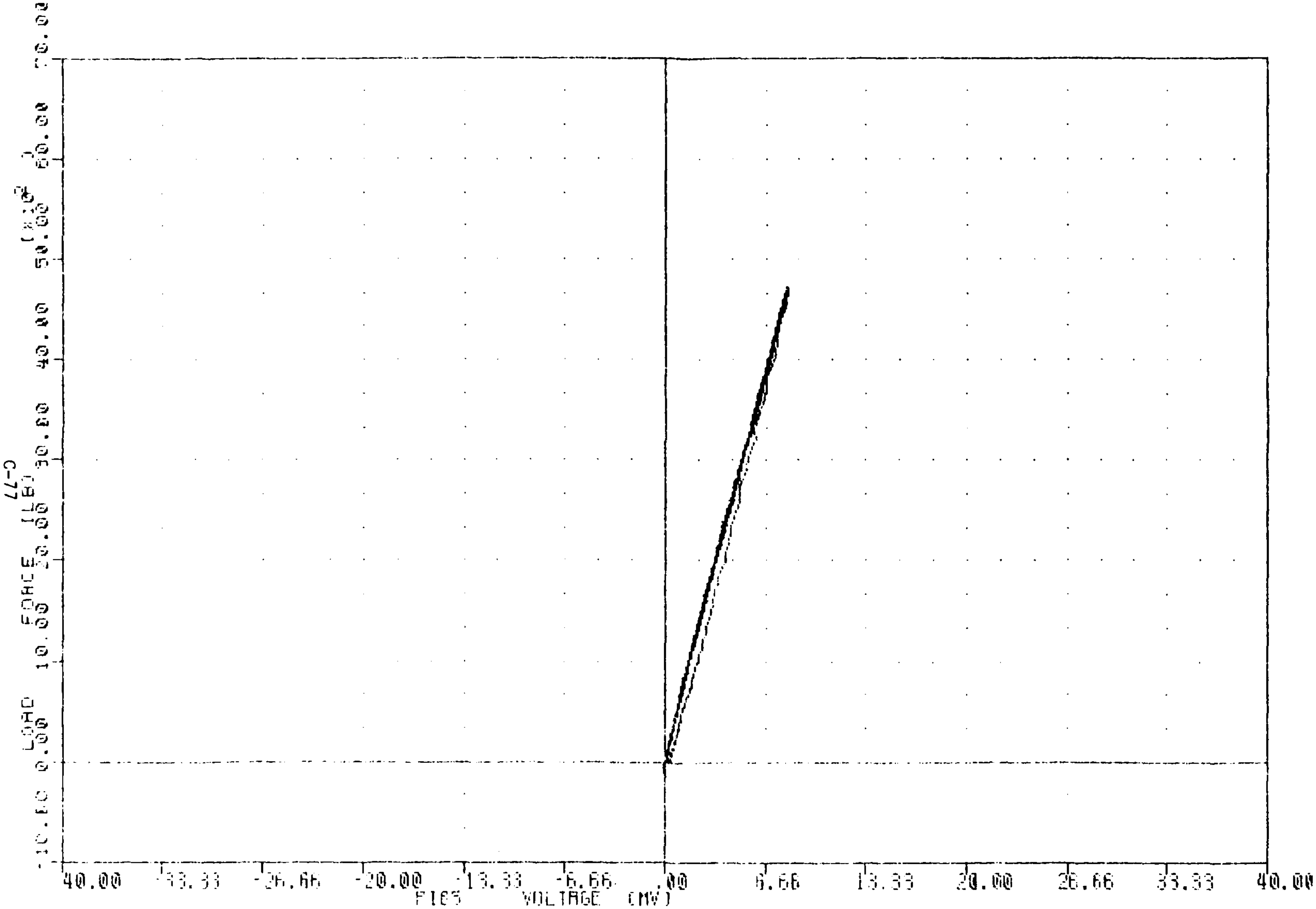
FAA	,TEST05	VERTICAL PULL TESTS		88071			
FOBS	FILTER = BLPF	100/ 316/ -40	MIN, MAX =	-0.06 @	0.93 ,	18.70 @	14.88
LOAD	FILTER = BLPF	100/ 316/ -40	MIN, MAX =	-120.95 @	0.38 ,	4730.23 @	14.88



LOAD APPLIED AT PORT OUTBOARD SEAT TRACK

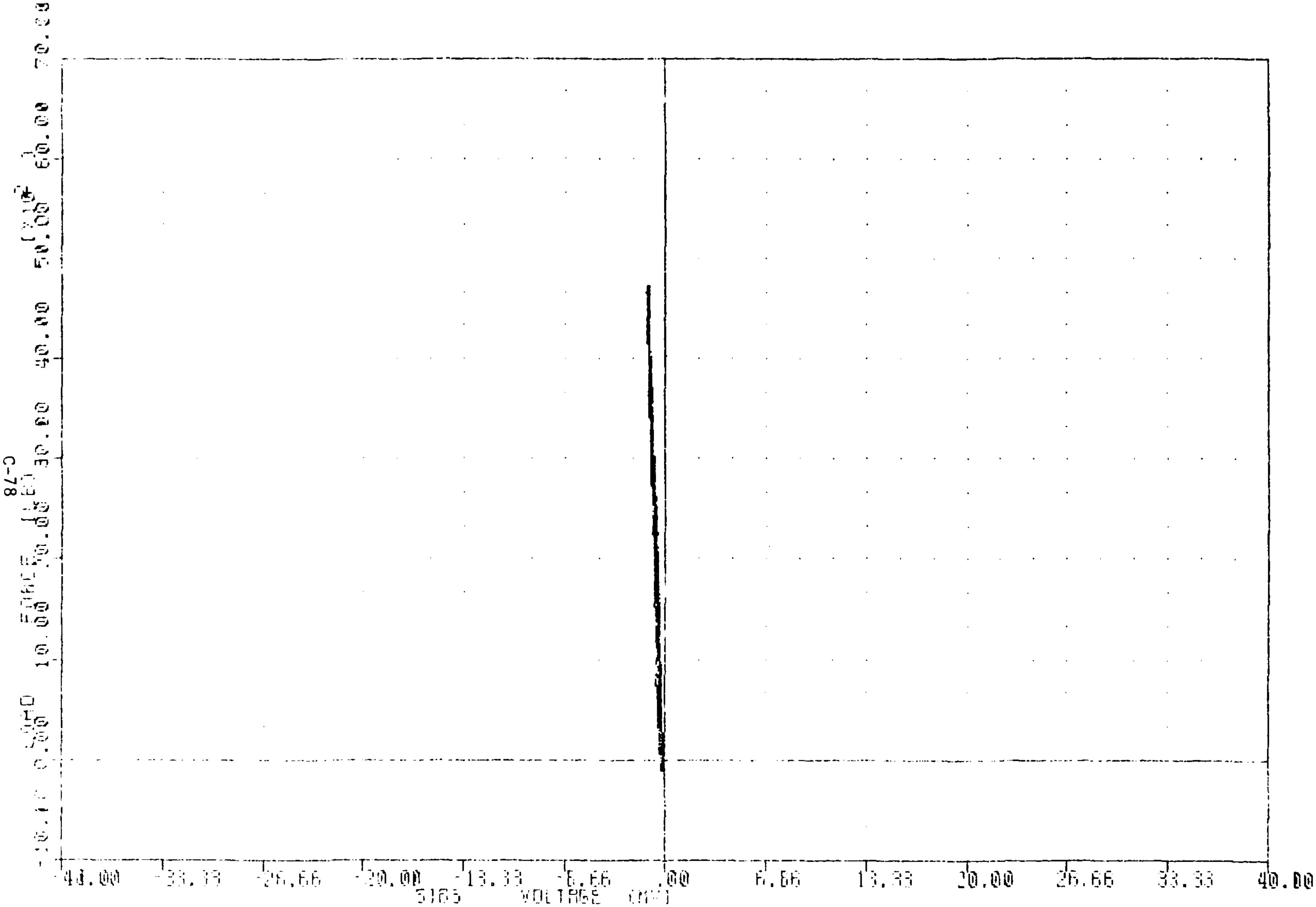
LOAD APPLIED TO SEAT TRACK VS PORT OUTBOARD BEAM STRAIN

FAA , TESTQ5 VERTICAL PULL TEST, 83071
FIB5 FILTER : BLPF 100/ 316/ -40 MIN, MAX : -0.15 @ 0.63 , 9.17 @ 14.88
LOAD FILTER : BLPF 100/ 316/ -40 MIN, MAX : -120.95 @ 0.38 , 4730.23 @ 14.88



LOAD APPLIED AT PORT OUTBOARD SEAT TRACK
LOAD APPLIED TO SEAT TRACK VS PORT INBOARD BEAM STRAIN

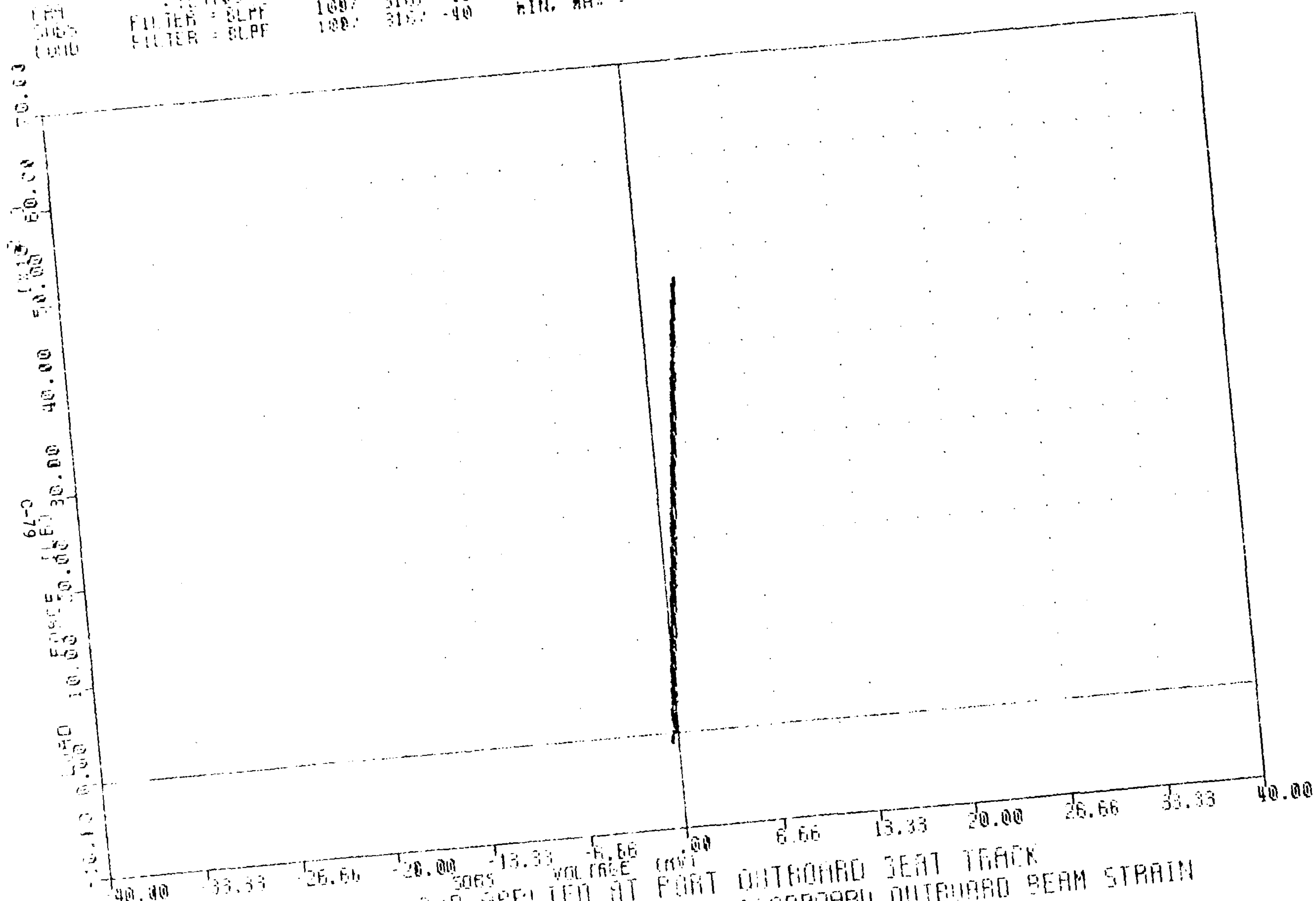
CHAN		VERTICAL FULL SCALE					
5165	FILTER - BLFF	100/ 316/ -40	MIN, MAX =	-1.29 @	14.78 ,	-0.16 @	0.71
LOAD	FILTER - BLFF	100/ 316/ -40	MIN, MAX =	-120.95 @	0.38 ,	4730.23 @	14.88



LOAD APPLIED AT PORT OUTBOARD SEAT TRACK

LOAD APPLIED TO SEAT TRACK VS STARBOARD INBOARD BEAM STRAIN

VERTICAL PULL TESTS



LOAD APPLIED AT PORT OUTBOARD SEAT TRACK

LOAD APPLIED TO SEAT TRACK VS STARBOARD OUTBOARD BEAM STRAIN

IMPACT SIMULATOR

General Description

The Impact Simulator is housed in a 25,000-square foot building which is designed and operated for proprietary testing, data reliability, and accuracy.

The test area is 88 feet wide and 95 feet long, with a deceleration area 35 feet wide and 142 feet long, Figure D-1. A 15-foot clearance above the track exists for tall payloads.

Hyge Description

The Impact Simulator features a 24-inch diameter, Hyge Shock Tester, Figure D-2. The Hyge principle, as applied to safety testing, simulates the deceleration conditions of an impact but in reverse. Prior to an actual crash, a vehicle and its occupants are moving at a constant velocity. At impact, they are decelerated very rapidly. With the Hyge system, the test vehicle and occupants (dummies) are initially at zero velocity. This situation simulates the constant velocity condition prior to an actual crash. The programmed, rapid acceleration, of the Hyge thrust column accelerates the sled with attached test article(s) and produces an impulse similar to that generated during the rapid deceleration of a moving automobile or aircraft during a crash impact. Depending upon the orientation of the test article(s), the crash loads can be applied to any axis.

The system can generate a gross thrust of 750,000 pounds which is capable of accelerating a payload of 10,000 pounds to 71 mph and attain a peak acceleration of 55 G's. Peak accelerations of 100 G's and velocities of 100 mph can be attained with lighter payloads.

The system is pneumatically operated and develops its thrust through differential gas pressure acting on the two faces of a thrust piston in a closed cylinder, Figure D-3. Compressed air is supplied to the load chamber by two 100 h.p. compressors. The main cylinder is separated into two chambers (front and rear) by an orifice plate. Each chamber utilizes a floating piston to vary the volume of the compressed gas within the chamber. The volume is changed by pumping "Pydraul" into or out of the cylinder, thereby, varing the position of the floating piston.

NOTE: "Pydraul" is a fire resistant, hydraulic-tyne fluid used to reduce the possibility of diesel explosions due to the high surge pressures generated when decelerating the thrust column.

In operation, a relatively low gas pressure in Chamber A forces the thrust piston against a seal ring seated on the orifice plate on the rear side of the thrust piston. Only the smaller area within the seal is exposed,

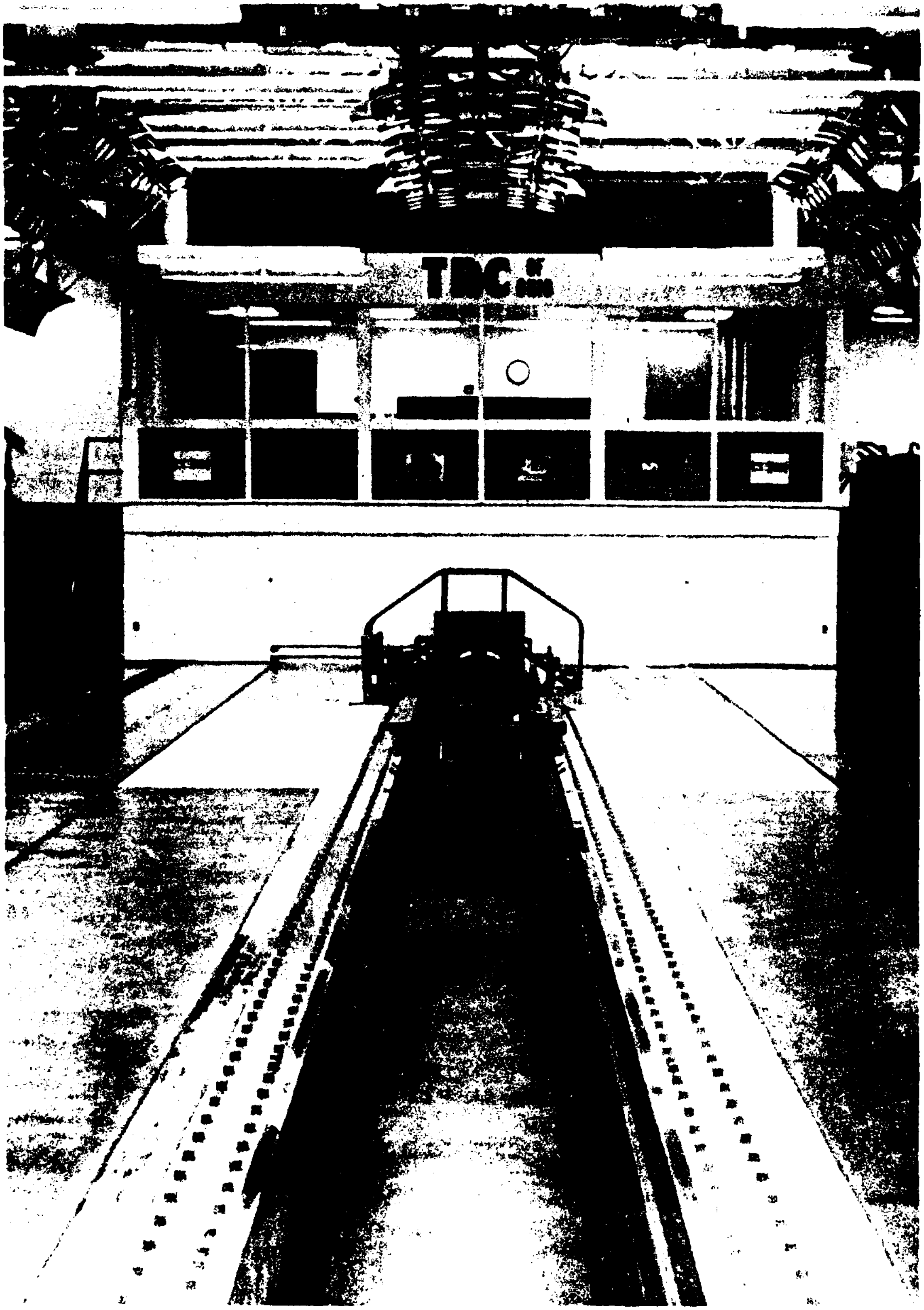
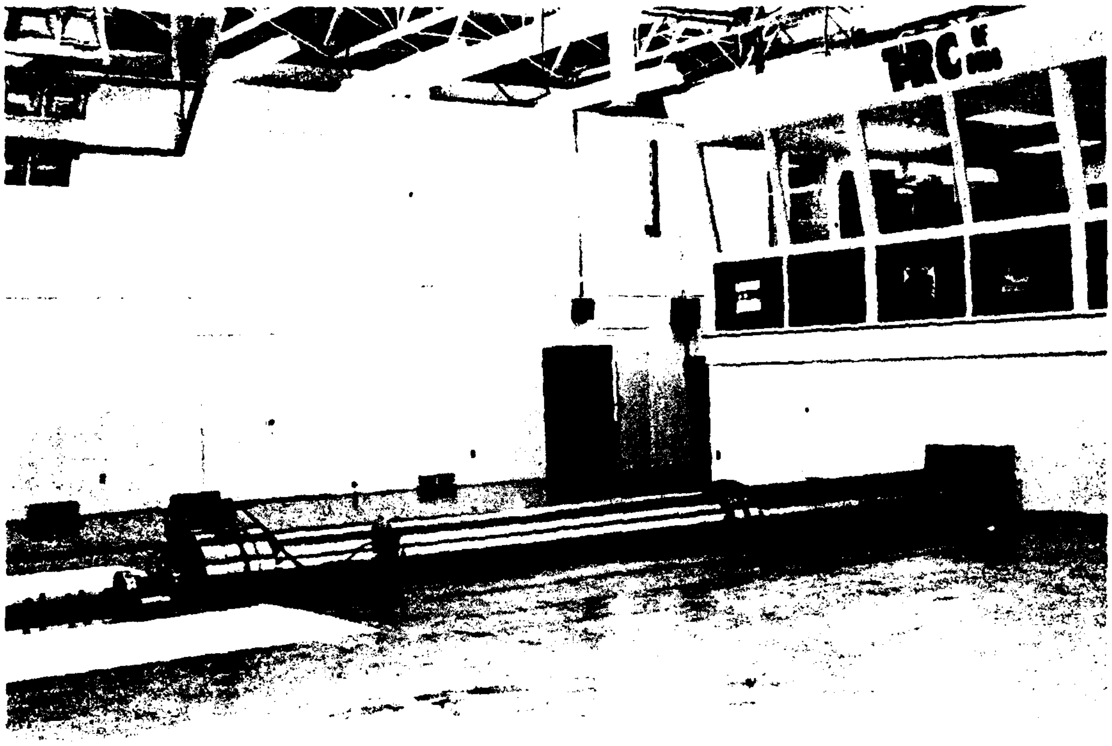


Figure D-1 Test Area



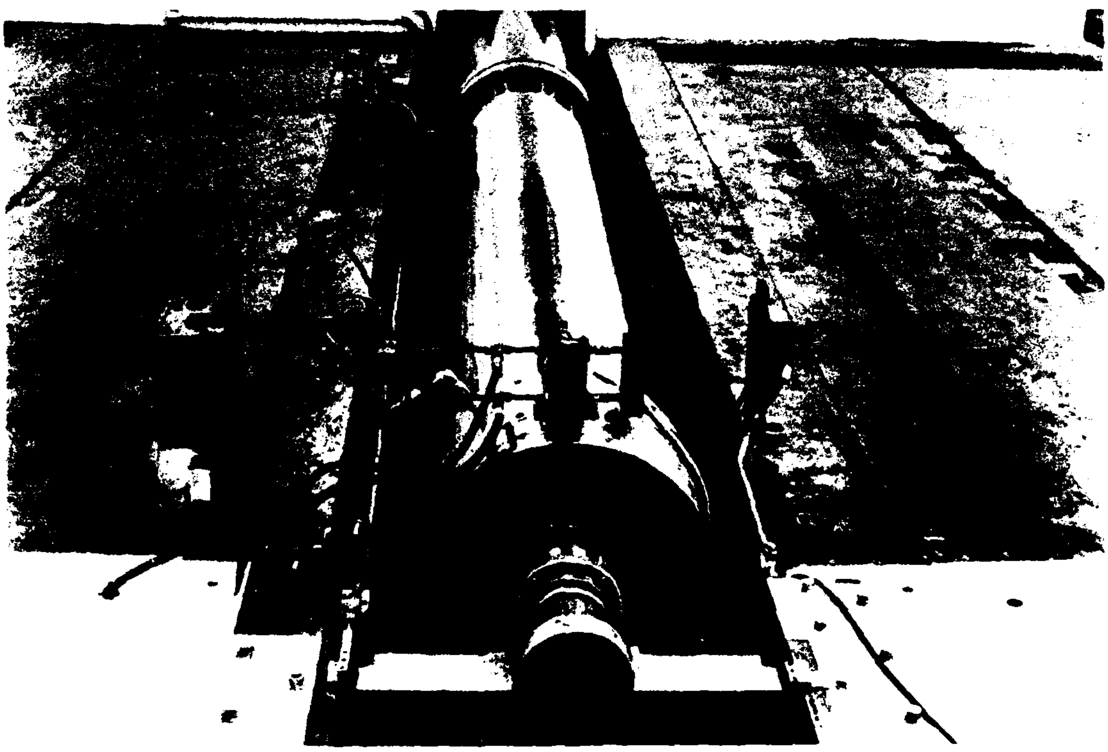
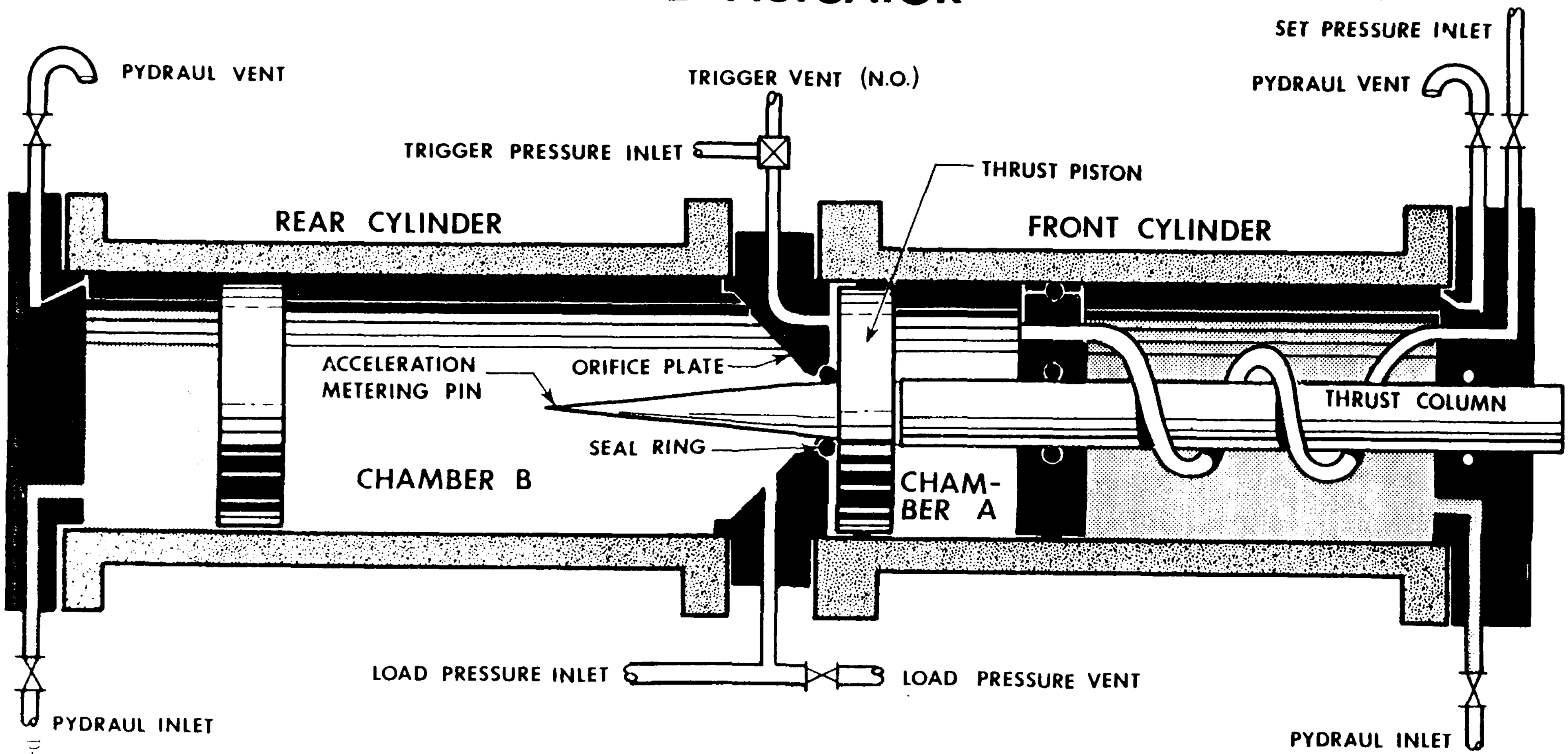


Figure D-2 Hyge Shock Tester

HYGE ACTUATOR



CYLINDER NET AREAS			
CYLINDER I. D.	REAR	FRONT	ORIFICE
24 IN.	452 SQ. IN.	374 SQ. IN.	50 SQ. IN.

Figure D-3 Hyge Actuator

through the orifice opening, to the gas pressure in Chamber "B". The ratio of the net areas of the thrust piston front and rear surfaces, which are exposed to the gas pressures in the chambers, is 7:1 with the front being the larger. This implies that as long as the pressure in the rear chamber is no more than seven times larger than the pressure in the front chamber the system is in equilibruim. To provide a margin of safety, the pressure ratios are never greater than 6:1.

In preparation for firing, compressed gas is introduced into Chamber B until the forces on the thrust piston are equalized. A low volume trigger pressure is injected which upsets the equilibruim, opens the seal at the orifice, moves the thrust piston away from the orifice plate, and instantly exposes the entire rear area of the thrust piston to the gas pressure in Chamber B. A controlled thrust on the piston results. Transmitted by a thrust column, this limited-duration thrust acts upon the test specimen to produce an accurately predictable acceleration or velocity.

Acceleration is governed by a metering pin which projects through the orifice into Chamber B. The contour of the pin meters the flow of gas through the orifice, regulating the acceleration and making the utilized thrust precisely repeatable, Figure D-4. By varying the volumes and pressures in Chambers A and B, the pulse amplitude and duration generated by a metering pin can be modified.

A computer program is utilized to aid in the design of metering pins. The program was used to design the pins to produce the triangular-shaped pulse for the testing of General Aviation aircraft seats,and the input pulse for child restraint testing per Federal Motor Vehicle Safety Standard 213, Figure D-5.

Illustrations of the basic wave forms generated by metering pins currently in our inventory are shown in Figure D-6.

Test Sled

The test sled has a top surface which is five feet wide and twelve feet long, Figure D-7. It weighs approximately 3,600 pounds and is designed to carry a maximum payload of 10,000 pounds. Pneumatic brakes provide up to 24,000 pounds drag force on the sled without causing deceleration irregularities. The brakes may be applied prior to the test to provide a smooth transition between the acceleration and deceleration phase, or they may be applied after the acceleration phase is completed. The sled is instrumented with accelerometers mounted to the center nose to measure acceleration in the longitudinal direction. The sled velocity is obtained by two methods: (1) a real time measuring system which utilizes a 12 foot long film strip, with precisely marked intervals, attached to the lower surface of the sled, Figure D-8. The film strip passes through a photo detector/light source with the output of the detector coupled to a "frequency-to-DC" converter whose output represents the sled velocity, (2) integration of the sled acceleration pulse.

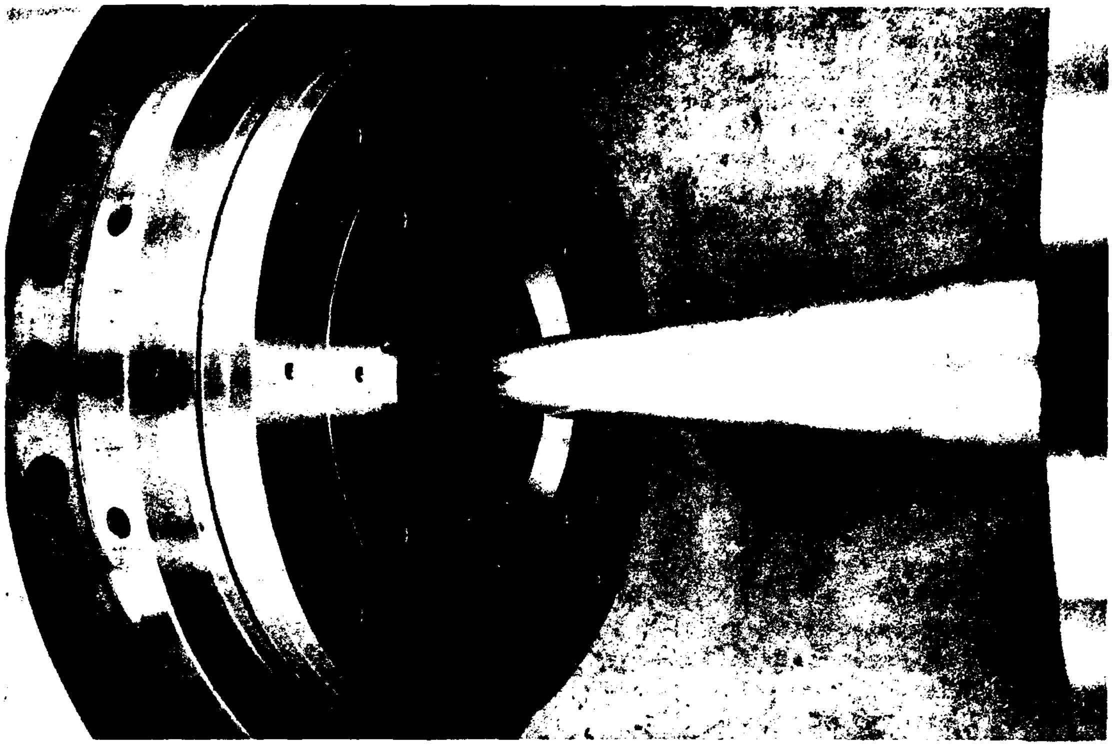
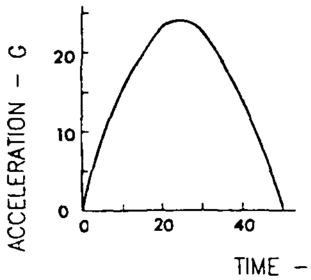


Figure D-4 Metering Pin and Orifice Plate

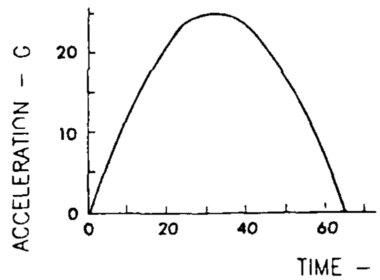
Figure D-5 Metering Pins for Triangle [illegible]
and Child Restraint Pulses

Figure D-7

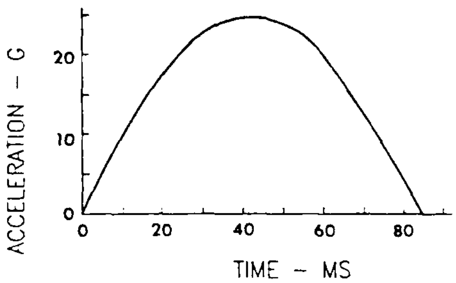
TRC SLED PULSES



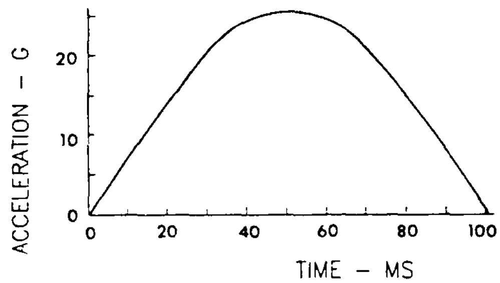
50 MS 1/2 SINE PIN



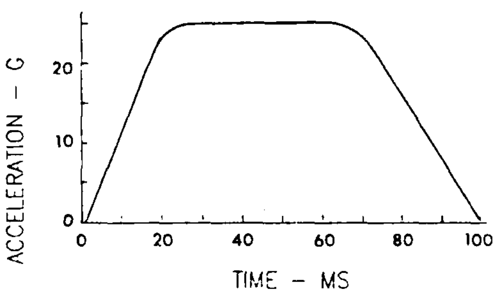
65 MS 1/2 SINE PIN



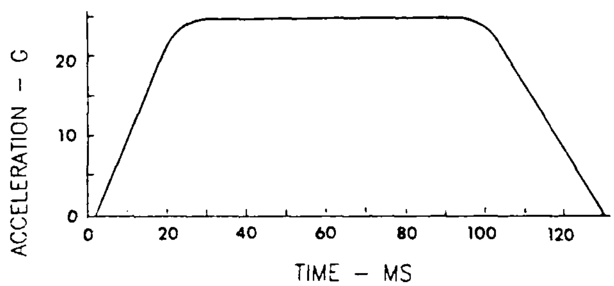
85 MS 1/2 SINE PIN



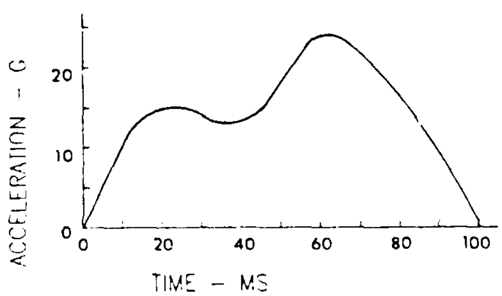
100 MS 1/2 SINE PIN



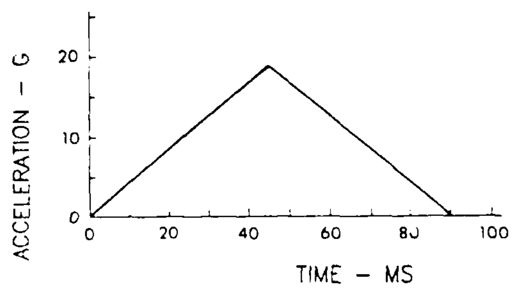
100 MS SQUARE PIN



130 MS SQUARE PIN



DOUBLE HUMP PIN



TRIANGLE PIN

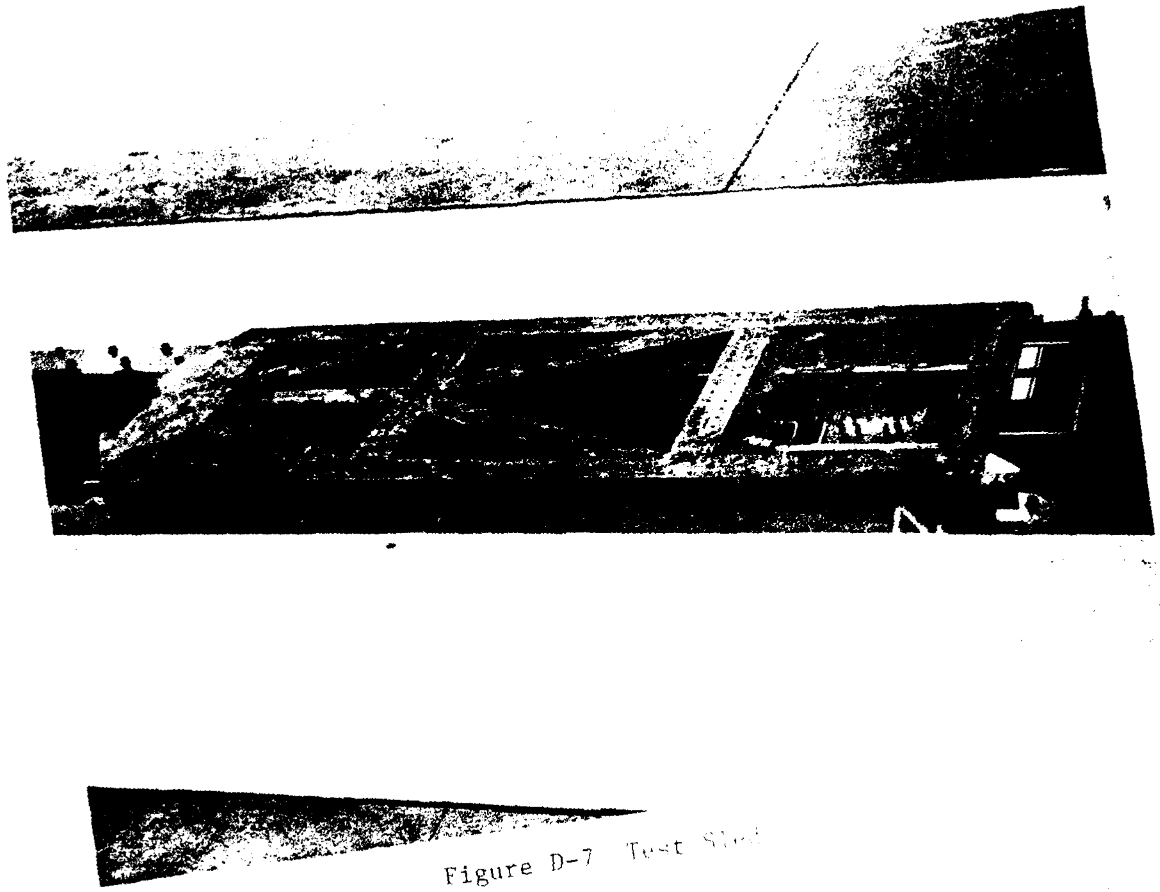


Figure D-7 Test Sl[illegible]

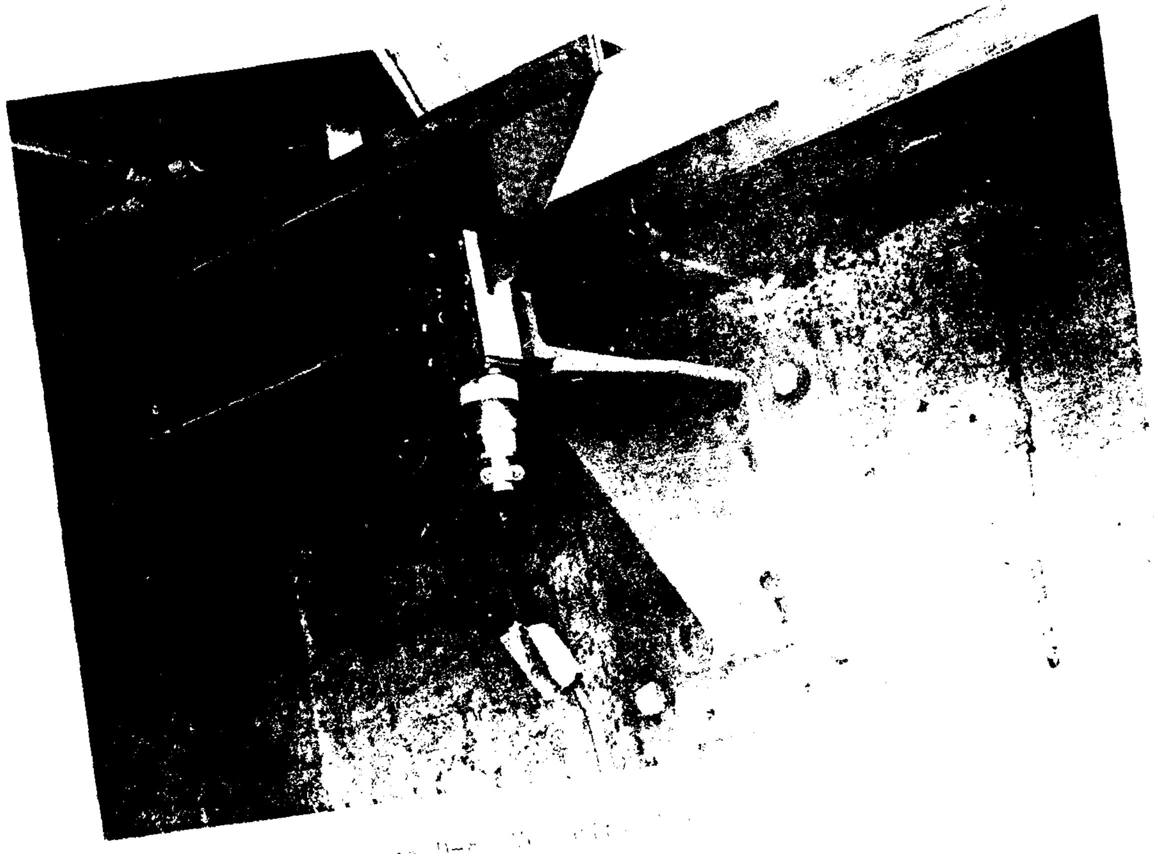


Figure D-[illegible]

Data Acquisition

The data acquisiton system has the capacity of simultaneously acquiring and recording, on magnetic tape, 56 data channels from sensors requiring signal conditioning, Figure D-9. Each data channel meets the requirements of SAE Recommended Practice, J211B.

Each sensor is connnected, via umbilical cable, to a signal conditioner located in the control room. The signal conditioners supply excitation voltage, amplification, filtering, and remote-controlled insertion of the shunt calibration resistors. The outputs of the signal conditioners are multiplexed and recorded on tape recorders. The analog signals are recorded, unfiltered, on one inch magnetic tape at 60 inches per second. IRIG "B" code is generated and recorded on each magnetic tape to aid in data processing.

Immediately preceding each test, all data channels are checked. After proper balancing of each channel, shunt calibration resistors are inserted, electronically, for each sensor and recorded on the magnetic tapes.

During the test event, selected data channels are recorded on an oscillograph to provide real time verification of the test data. Twelve (12) channels of data can be presented on the oscillograph at the time of the test.

Data Processing

The data processing system includes the analog to digital convertor and the computer with its associated peripherals, Figure D-10.

The analog-to-digital convertor is a 16-channel system with each channel having a simultaneous sample and hold amplifier. The digitizing rate is software-selectable with a maximum throughput of 160,000 samples per second. The computer is a VAX 11/780, 32 bit processor, with 8 megabytes of main memeory.

Peripheral equipment includes the following:

- o Model RM05 megabyte hard disk
- o Model RA81 456 megabyte hard disk
- o Model RX02 dual floppy disk
- o Model TU77 tape transport
- o Model 7221T H-P eight pen plotter
- o Floating point processor
- o Thirteen (13) terminals including a Model VT105 waveform graphic terminal

Analog and/or digital filtering of the data can be performed. The filters conform to the Society of Automotive Engineers Recommended Practice J2112b. The digital filter types include Butterworth, Tchebycheff, and Elliptical. The number of poles can be varied from one to ten. Phaseless filtering can also be accomplished with either of the filter types.

Routine calculations include Head Injury Criteria (HIC), resultants from

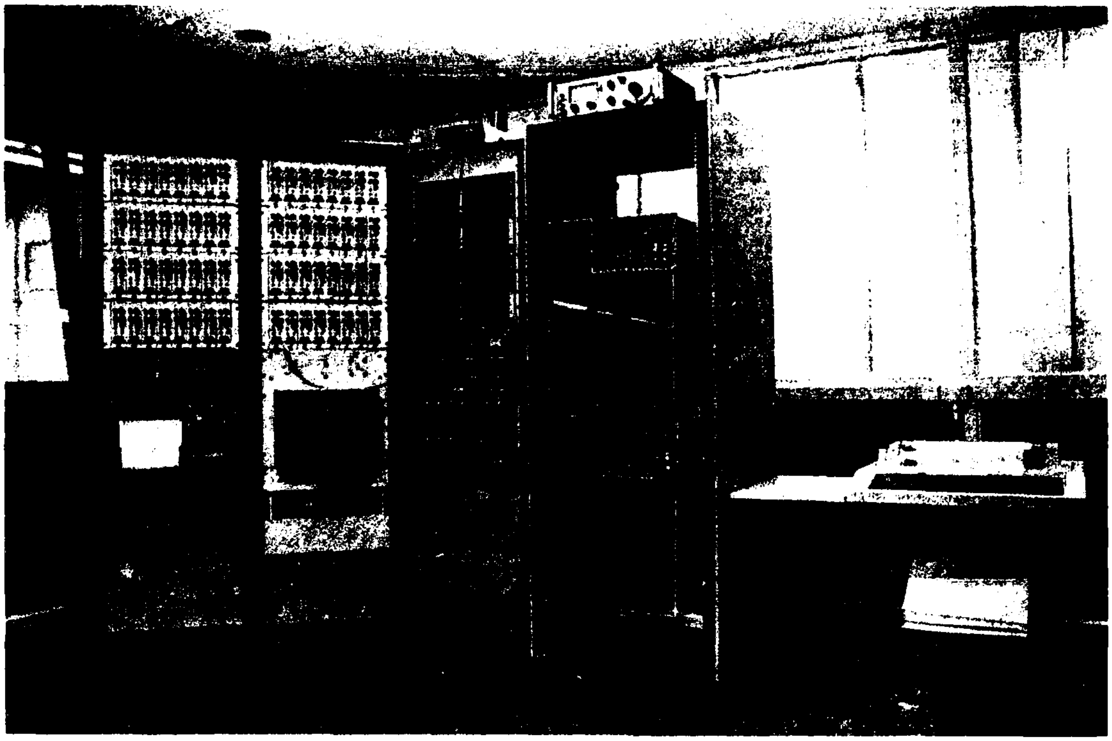


Figure D-9 Data Acquisition System

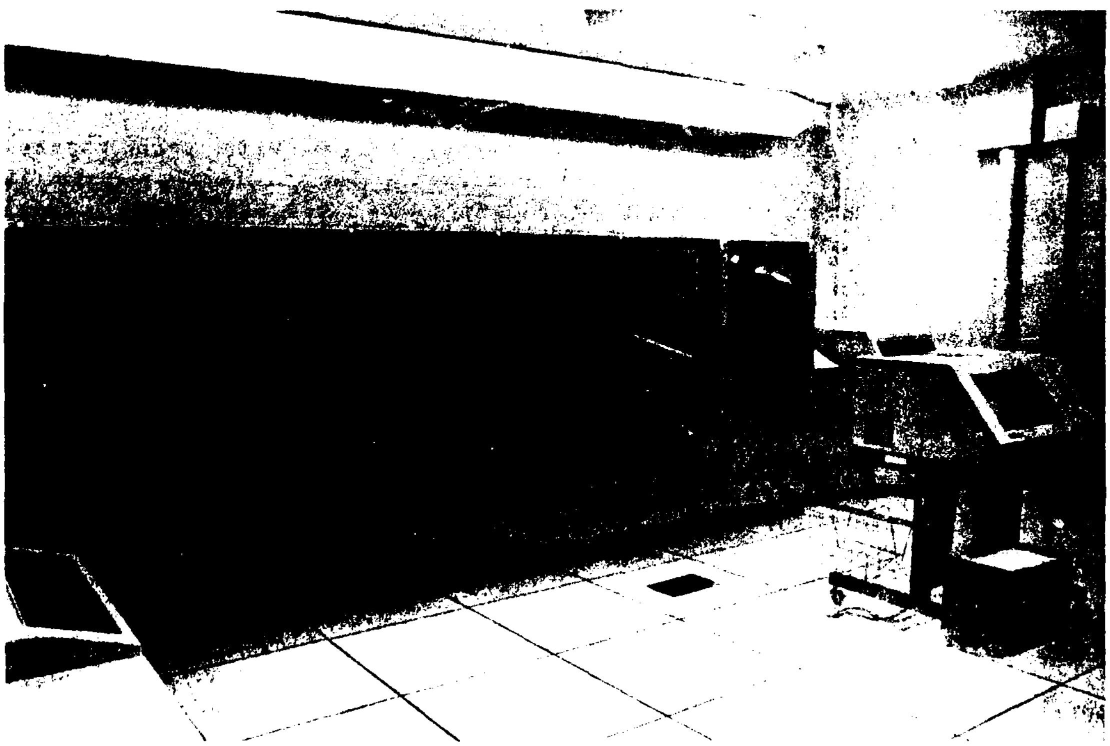


Figure D-10 Data Proce[illegible]

orthogonal measurements of accelerations, forces or moments, thorax (three ms clip) acceleration, the proposed lower leg injury criteria for the Hybrid III Dummy, and pass/fail criteria for dummy calibrations.

The data is presented in tabular and/or graphic form and also on magnetic tape, if desired. Various types of tape formats are available.

Photography

High speed, motion picture, cameras are employed to provide slow motion (1000 fps) coverage of each test, Figure D-11. Higher or lower frame rates can be selected. Five onboard and four offboard cameras, with lenses ranging from eight to 50mm, can be utilized to provide side, oblique, frontal, rear, and overhead views, Figure D-12. Real time (24 fps) motion picture cameras, a video tape system, and 35mm documentary cameras are available.

Two hundred and ninety-six (296), 1,500 watt, Tungsten-Halogen lights provide sufficient lighting for motion picture photography at 1000 frames per second. Auxiliary lights can be mounted onboard the sled for test articles which shield the overhead lights from specific areas of interest.

Film processing for the 16mm color motion picture film, (VNF-1 process), Figure D-13, and 35mm color documentary film (C-41 process) are performed in the photograph laboratory located in the Impact Simulator building. Black and white 35mm film can also be processed. The laboratory is equipped for editing and titling the motion picture film, as well as, enlarging and printing color and/or black and white photographs up to 16 by 20 inches. Proof sheets, slides, and view graphs are available.

Schematics, illustrations, and/or computer generated graphics, Figure D-14, can be provided for test reports, publications, proposals or other requirements.

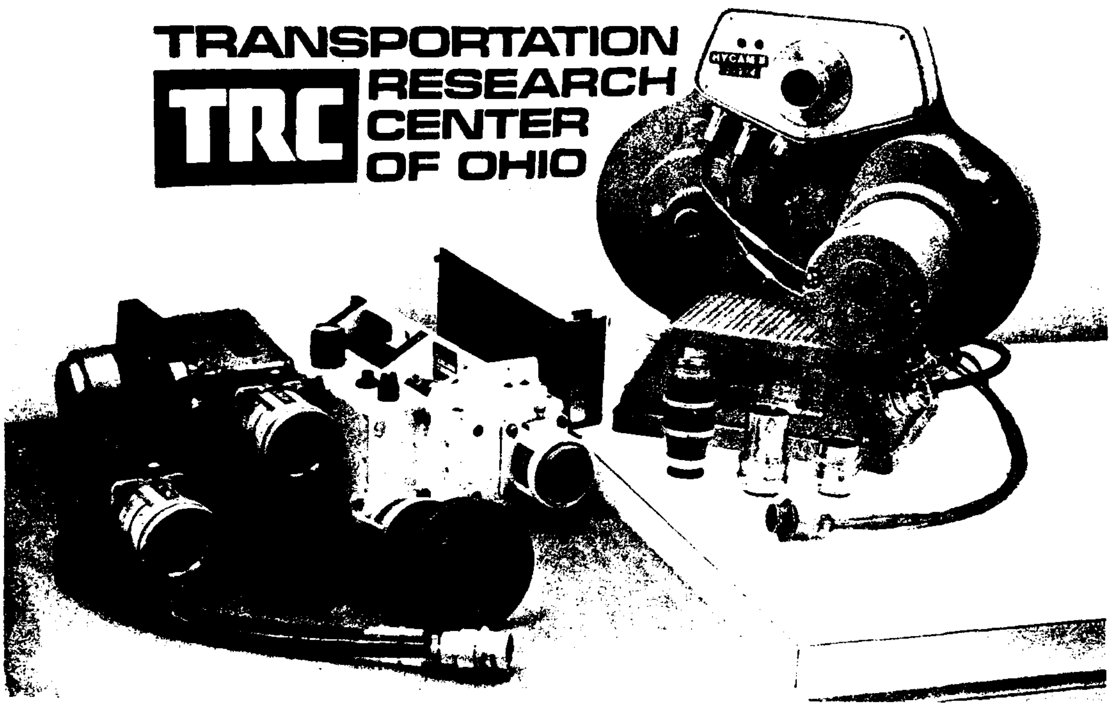


Figure D-11 Motion Picture Cameras

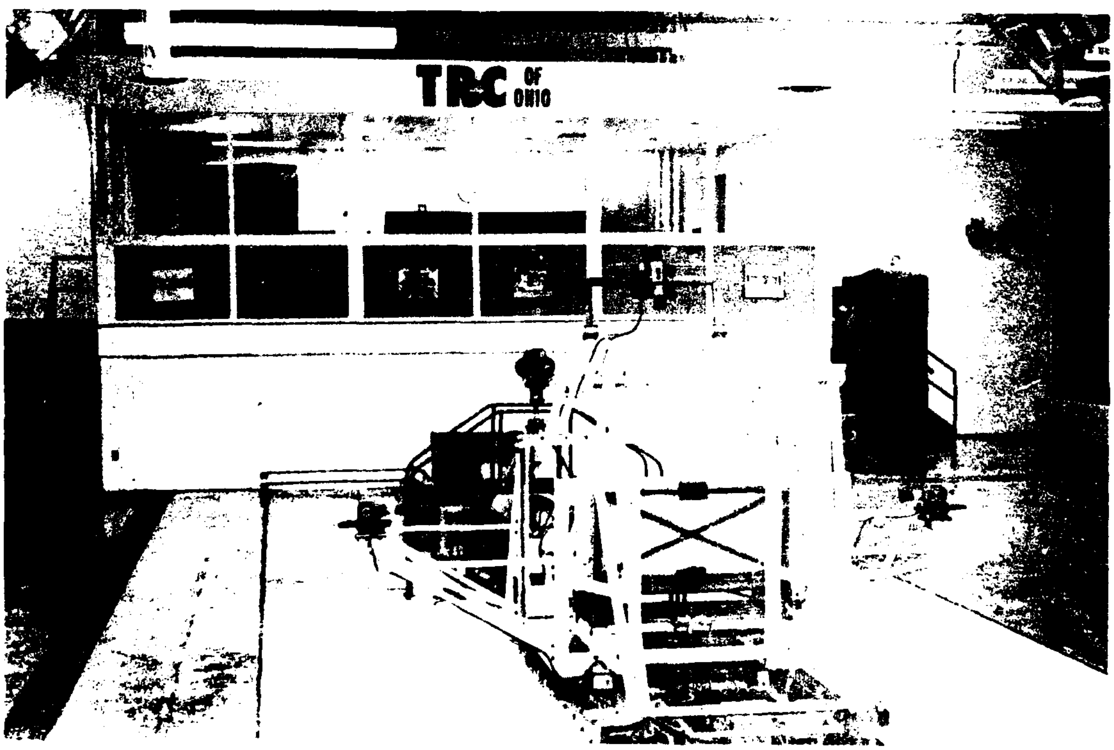


Figure D-12 Test Buck with [illegible]

Figure D-13 Motion Picture Processor

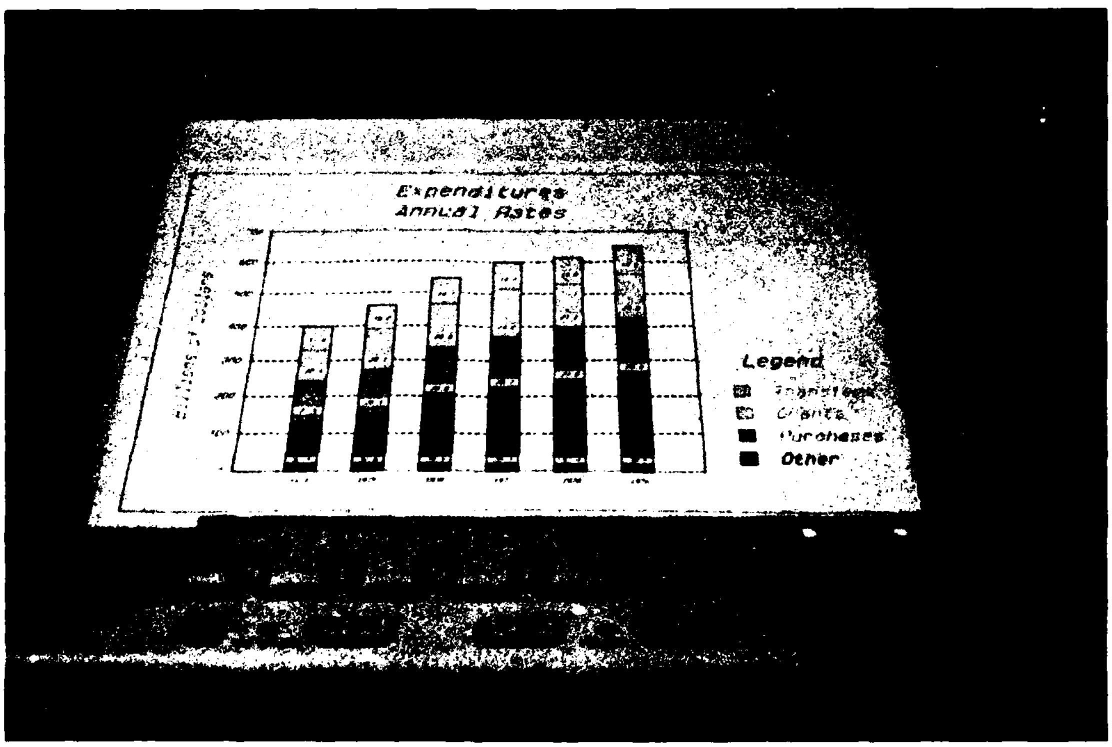


Figure D-14 Computer Graphics

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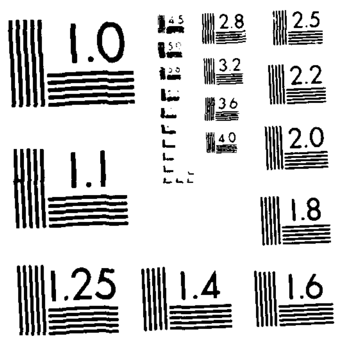
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